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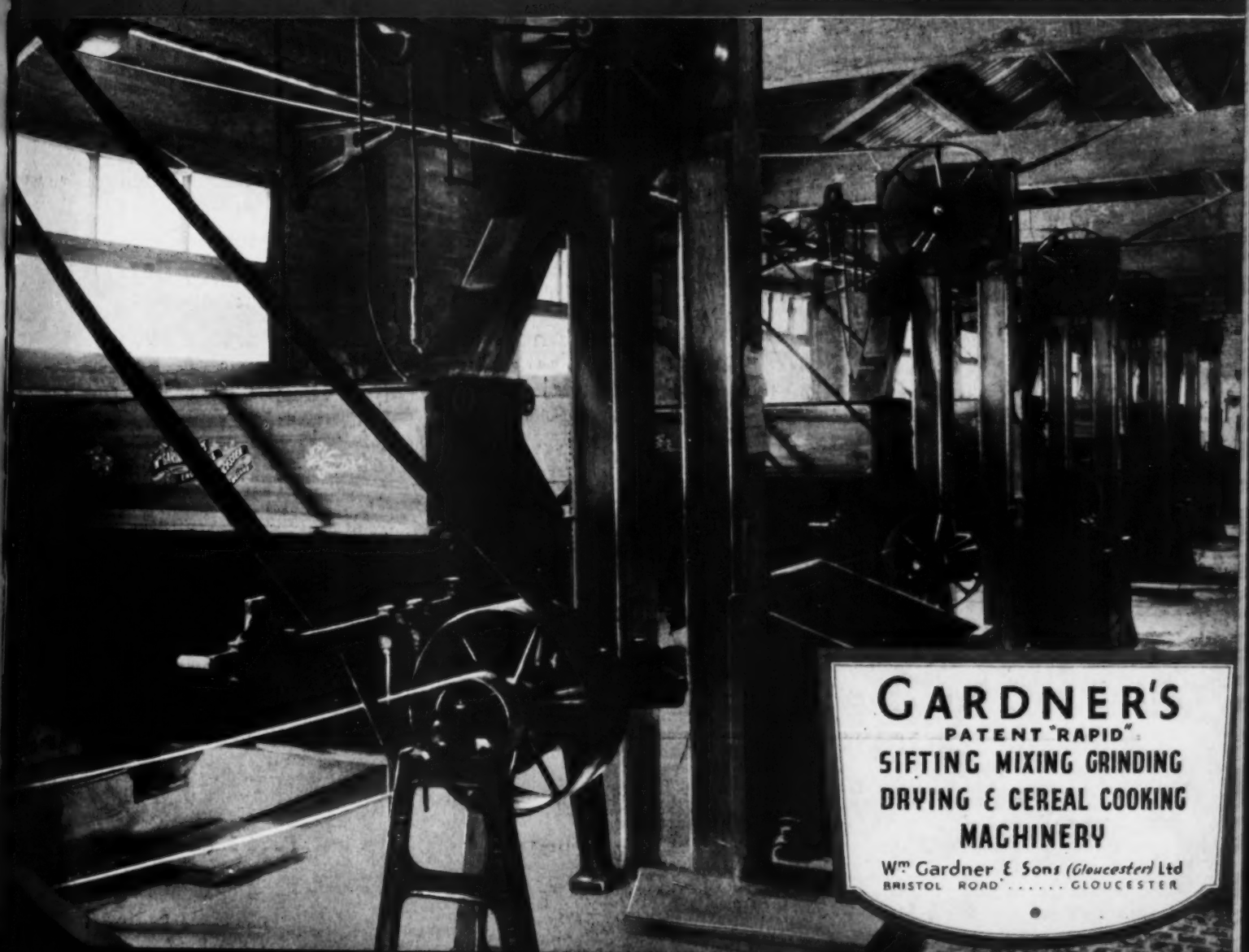

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FOOD MANUFACTURE

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The Editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings when possible.

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FOOD MANUFACTURE

Vol. XII, No. 5 May, 1937

In our position as the oldest journal in the Empire representing the Food Industries we respectfully offer on behalf of the Food Manufacturers of the Empire

Loyal Greetings to

HIS MAJESTY KING GEORGE THE SIXTH

Long may he reign
over a united Empire
in a peaceful world

The Budget and Food

EVERY FOOD manufacturer will have heard with relief and pleasure that there is to be no increase in indirect taxation of food products and no change in the medicine stamp duties at present. The Chancellor of the Exchequer had to find a good many more millions of revenue to meet increased armament expenditure and to prepare for greater increases in the next two years or so; but we never really imagined he might impose any new tax on food commodities of any description. We did not, of course, expect any relief. Also, as we said last month, we felt certain that patent foods would not be included within the scope of any new medicine stamp duties; and though the report of the Select Committee has obviously not yet received consideration, we are still of the same opinion.

So far as the National Defence Contribution is concerned, food manufacturers, surely, have little to fear. They are not armament manufacturers, and they are among those least able to make excessive profits because the prices of their products are so well known to everyone and so easily subject to critical examination. Prices of processed food products have not fluctuated widely during recent years, and profits have not varied greatly from depression to prosperity. The big increases in prices of commodities during the past year or so, such as wheat, for example, have actually operated against the manufacturer of processed foods. A tax on profit increase should therefore be relatively small, and it is only fair that it should be small for an industry supplying the first real need of the people of the country. If the new form of taxation encourages the improvement of manufacturing technique by the spending of more on scientific control and research, on hygienic methods of processing, and better distribution, it will have served a very useful purpose.

Agriculture and Industry

The recently issued report of the special committee appointed by the Association of British Chambers of Commerce to consider the position of British agriculture and industry contains many interesting facts. The report makes the point that Great Britain, by her policy of opening up agricultural areas overseas and enabling her debtors to pay in goods and services has helped herself to sell her manufactures abroad and her population to live better and more cheaply than ever before. If this were the only side to the picture everything would be rosy but, unfortunately, this policy has exposed her farmers and landowners to fierce competition

to such an extent that they have been almost starved out of existence. The problem that faces economists and politicians to-day is how to balance the two factors and, at the same time, provide cheap food for the worker and a fair price for the farmer. It is important to realise that our people require food at a low price and of the best quality and in the large quantity which the low price enables us to consume. We must also remember the obvious advantages of growing and harvesting grain crops overseas on wide tracts of land which enjoy a stable climate, and also of raising beef and mutton in suitable places. The low cost of sea transport and the ease of production make it possible for these commodities to be imported at prices below the cost of production in this country. We have frequently urged the greater production and consumption of fresh home-grown vegetables, fruit, milk, butter, eggs, and poultry. With a little assistance in the way of import regulations these commodities might well be grown in largely increased amounts and become a really prosperous section of home agriculture.

Cheap Food Necessary

The importance of cheap food is twofold. Our industry cannot afford to pay more than the world's price for its prime raw material, which is the food of its workers. It would be folly for farmers both here and abroad to permit high retail prices to limit consumption, as it is by increased and maintained consumption alone that agriculture can continue to exist. We have seen, in this country, that an increased production of milk did not help farmers, as the increase was not consumed at liquid prices, but turned to manufacture at disastrous prices. Our agricultural policy should be to keep the land fertile and in good heart as best suits the soil and climate of each farm. In addition, the Government should hold itself free to use tariff or levy, quota or subsidy, or distributive control, separately or in combination, bearing in mind the dangers that are imminent when, in the supposed interest of British agriculture, it restricts the supply or forces up the retail price of food to prices which restrict consumption. By permitting the British public to buy world food at prices below cost the Government secures for home industry a large financial gain, part of which can and should be used to prevent the unnatural cheapness of food from causing distress to our agriculture. The main point to be borne in mind is to encourage the right type of crop. It is of no apparent advantage to force up the price of wheat and sugar as has been the case with some European countries. It has been accepted as an essential to grow a certain amount of wheat in this country. When world prices were lower than production costs farmers received compensation raised by a levy on every sack of flour milled in the country. There would be no advantages in increasing the acreage under wheat as the best wheat-growing land is used for wheat now. The continued production of sugar beet is, to our mind, most uneconomic. Any increase in it would be absurd. There are many other crops which would pay better and have a greater nutritional value.

World Situation

Discussing the world situation, the report goes on to say: "While we gain as consumers by the refusal of nations of continental Europe to buy food from overseas, we lose by the consequent disturbance of trade in the world, and should use our buying power to open the food market of Europe to the farmer overseas. While the new countries gradually rely less upon selling food and increasingly employ their people on secondary industry, many of them must still rely for their foreign exchange on the sale of farm products, and the market of Europe must be opened to their farmers before they can expand, invite settlers and loans from Europe and start again the spiral of progress which we urgently require for prosperity and even for peace. To open the market of Europe to food from the Dominions requires a measure of economic appeasement which will remove from European nations the feeling that a burden of debts and hostile nationalism combine to exclude them from world trade and to shut them off from raw materials."

The International Sugar Conference

At the time of writing the International Sugar Conference is still pursuing its ponderous course and little or no information has been issued. One never quite knows how international conferences will turn out. They are opened with high hopes expressed by everyone and proceed to deadlock often because one or two nations will not come into line. A formula is then sought which will satisfy the recalcitrant as well as agreeable members and a compromise doomed to failure is the result. However, we hope this will not be the result with this Conference. According to the latest bulletin the work of the Committee instructed to carry on negotiations is progressing in a spirit of mutual understanding. Another Com-

mittee has been considering how to encourage increased consumption of sugar. Figures for sugar consumption vary very much between different countries and for various reasons, such as differences in purchasing power of the people, in retail prices, and in the comparative importance of sugar-using industries. Denmark heads the list of European countries with 55·9 kilos per head per annum. Great Britain comes next with 47·8. France and Germany are of the order 7·24, Italy only 7·9, with Turkey at the bottom at 4·6. For countries outside Europe computation of figures has been more difficult. Differences of climate and standard of feeding enter in. New Zealand leads with 55 kilos per head per annum, the U.S.A. figure being 43. Retail prices vary in Europe from about 4·5 pence per kilo in Denmark (5 pence in Great Britain) to 37·2 pence in the U.S.S.R. In the overseas countries it may be as low as 2·2 pence in Cuba and 8·8 pence, the highest, in Australia. Such wide differences seem on the face of it quite absurd for such a simple commodity of worldwide consumption, and it is confidently to be hoped that sensible adjustments of tariffs will be made to level out these prices and increase consumption.

A Useless Polemic

In the meantime Mr. T. G. Mathieson, Chairman of the Sugar-using Manufacturers' Committee in this country, and Sir Leonard Lyle have been carrying on a polemic in the columns of *Food Industries Weekly* and *The Times*. Emphasising the necessity for maintaining the exports trade of this country, Mr. Mathieson points out the suitability of sugar products which are so well preserved for the export trade, especially as their manufacture in this country is more highly developed than elsewhere. When all sugar was imported, he argues, the calculation of the drawback on the import duty presented no difficulty; but, he says, a change for the worse has come with the efforts to manufacture at home from sugar beet and to keep the peace with our sugar refining industry by the imposing of an extra duty on imports of sugar refined abroad, which has proved prohibitive. Sir Leonard Lyle, on the other hand, retorts that Mr. Mathieson is an "ardent publicist," and that the sugar refiners have done well for the country by improving their technical and commercial efficiency, and have themselves overcome tariff walls in many parts of the world without setting up factories in the tariff countries as the confectionery manufacturers have done.

Well, we might ourselves go on discussing the various arguments *ad nauseam*, but that is not our intention, nor was it our object in writing this paragraph. Obviously there are difficulties, indeed great difficulties, to be overcome, and they are not likely to be overcome by two men in such important positions in their own branches of the industry, so closely interdependent as they are, being at loggerheads. There is only one way in which conditions can be improved, for one as much as for the other, and that is by co-operation. We see no useful purpose in the prolonging of this polemic.

Sugar Subsidy Sallies

There were some amusing sallies in the House of Commons last month when Mr. James Griffith asked the Minister of Agriculture for the total amount of subsidies paid to the beet sugar industry up to the end of 1936, the average annual cost to the State since the subsidy began and the number of workmen employed in the industry. The answer revealed that the actual subsidy paid had totalled over £39,000,000 and that the permanent workers numbered 2,250. Mr. Gallacher then wanted to know if it would not have been better to give the 39 million pounds to the two thousand odd workers and let them retire on it? Of course, there is a fallacy in it, but so much has been said about the unemployment that would be caused if the sugar beet industry were stopped that the total of 2,250 permanent employees seems ridiculously small. In any case, looking at it from an employment point of view, it has been very costly, as from the figures given it would appear that it has cost the State nearly £20,000 to keep each employee going for ten years. £2,000 a year each for men in the sugar beet industry isn't bad going. No wonder they won't join the Army!

Canned Goods Damaged by Water

Following the recent heavy floods in the United States of America, when stocks of manufactured goods were severely damaged, the National Canners Association issued instructions for the guidance of those wishing to recover stocks of canned goods which had been damaged by water. Although the foods in the cans cannot be contaminated by water, it is nevertheless necessary to treat the damaged cans in such a way as to ensure that perforation will not ultimately result from rusting from the outside. The following treatment was suggested, and the information may some time prove of use to canners in this country: (1) Remove labels and wash cans in warm, soapy water. (2) Follow the cleansing treatment by immersion in a chlorine solution or other suitable sterilising solution.

Phenol, cresol or other coal tar disinfectants are unsuitable since the odour imparted by such solutions is objectionable and persistent. (3) Rinse the cans in fresh water and dry thoroughly to prevent rust. (4) Repack in dry cases and store in a dry place as is usual. If chlorine is used as a disinfectant, a solution having an alkaline reaction is recommended since such a solution tends to prevent rusting of the cans. If a solution of this type is used there is no need to rinse the cans in fresh water, but they should be dried promptly. The cans may be relabelled as soon as they are dry.

Adulteration of Pepper

Ground pepper has rather a bad reputation as an article subject to adulteration. In a letter to the *Analyst* (February, 1937), Dr. J. T. Dunn and Mr. H. Charles L. Bloxam report on four samples recently examined by them, two of which were found to contain a new adulterant—namely, magnesium carbonate—in one case 7 per cent., in the other 8 per cent. As the writers point out, the adulterant is difficult of detection, as it is likely to be missed in the microscopical examination; and, although it naturally leads to a high figure for the ash, this may not arouse suspicion, unless the ash is recarbonated. The appearance of the two adulterated samples was excellent, the magnesium carbonate tending to reduce the colour; and the adulterant is a tempting one, as not only does it improve the appearance of the pepper, but its cost is only about one-third that of genuine ground pepper. Food manufacturers should be grateful to Dr. Dunn and Mr. Bloxam for exposing this fraudulent practice, and, now that the potentialities of magnesium carbonate as an adulterant of pepper are known, food chemists will be on the look-out for it in other samples giving a high ash.

Vinegary Vagaries

A prosecution at Bow Street against a trader who sold 100 per cent. artificial vinegar as "table vinegar" led to a right battle royal in which a variety of scientific talent was displayed. After much wordy warfare, during which, for the first time, it was suggested that malt vinegar contained vitamins B and C, the magistrate reserved judgment and agreed to state a case. After a month's consideration the judgment was given. The magistrate said that the question he had to determine was whether it was permissible to sell as vinegar a substance which was not malt vinegar and which was non-brewed. Since the early part of the seventeenth century the commodity ordinarily sold in this country as vinegar was the product of fermentation, and it was not until 1890 that the "artificial" fluid in question made its appearance on the market, although possibly there might have been isolated cases in which it was sold as vinegar as far back as 1860. Both vinegar, which was the product of fermentation, and the substance sold in this case were composed of acetic acid diluted with water in much the same proportions, but the acetic acid in the one was produced in a way different from that in the other. The vinegar produced by fermentation gave the finished article a better aroma and flavour. The defendant was fined. This case opens up an interesting point. Has the method of production anything to do with the final product? Is a dilute solution of acetic acid prepared by one method any different from the same strength solution made by a different method? If this is accepted, what about beet sugar? Until very recent times sugar in this country was always made from sugar cane. Is it now to be considered a misdemeanour to call the substance extracted from sugar beet by the name sugar?

Frequent Adulteration

The adulteration or sophistication of vinegar is no new conception. It is said that Ambrose Godfrey frequently adulterated it with sulphuric acid. That great sleuth on the adulteration of food and culinary poisons Frederich Accum stated: "We frequently meet with distilled vinegar adulterated with sulphureous acid, the presence of which is detected by means of nitrate of barytes or acetate of lead". Later on Dr. Hassall, who wrote many treatises on food adulterations and the methods for their detection, gave actual statistics about the vinegar sold in his day. Of thirty-three samples examined, twelve did not contain sulphuric acid, and eight contained less than 0·1 per cent. The other thirteen samples all contained sulphuric acid in excess of that amount. The percentage of acetic acid varied from 2·29 to 5·1 per cent., showing that considerable adulteration with water took place. Normandy, in his *Commercial Handbook of Chemical Analyses* about 1850, states that, in order to make up for the loss of strength or through carelessness, vinegar frequently contained such substances as hydrochloric acid, pyroligneous acid, pepper, capsicum, and mustard. Even nitric acid was not unknown. Thus vinegar seems to be one of those commodities that have lent themselves to frequent adulteration and the recent case, while not one exactly of adulteration, brings the nefarious history of vinegar right up to date.

Extraction and Standardisation in FRUIT JELLY MANUFACTURE

By George L. Baker

Delaware Agricultural Experiment Station

INTEREST SHOWN in the methods developed by the Delaware Agricultural Experiment Station for viscosity control in the manufacture of jelly, jam and marmalade has been such as to warrant further discussion of regulatory procedure to produce standard conditions. The development of extraction processes in the case of juice for jelly purposes and of correct cooking conditions for fruits for jam or marmalade has evidently not been carried out as fully as possible and needs more attention in manufacturers' laboratories. A company laboratory, in developing processing formulas for fruits in general use, should consider average degree of ripeness as well as climatic and seasonal conditions of growth. Where possible these formulas should be developed to conform with specific variables in the company's factory, and proportions should be such as to control the development of flavour as well as definite physical properties of jellying.

The present discussion considers means, first, of extracting or of making available for jellying as much of the pectin naturally present in the fruit as possible, and, secondly, of standardising the jellying value of the extracted juice or cooked fruit to a constant sugar requirement. A constant sugar requirement will assure similar cooking-time periods (under same cooking conditions) and a more standard product as far as flavour and consistency are concerned.

Extracting the Fruit Pectin

In addition to such variables as are found in the equipment in a factory, proportion of fruit to water, and time, temperature and *p*H of extraction affect the jellying quality of extracted juice for jelly or cooked fruit for jam and marmalade. These factors should be considered in the development of processing formulas in a company laboratory.

The time of cooking the prepared fruit for jellied products depends, naturally, upon the type of fruit. Soft fruits require only a short period, while hard fruits require a longer period of cooking to bring about softening of the fruit tissue and the production of an extract which will have the maximum jellying capacity. Maximum jellying capacity will appear at the point of greatest viscosity and not necessarily at the point where greatest amount of water soluble pectin is found. The time of cooking will not be considered further, but will be thought of as a constant in the present discussion.

Although the temperature of extraction has proved an important factor in producing fruit juices of better flavour, only extraction at boiling temperature will be written of at this time in the consideration given to the effect of proportion of fruit to water and the *p*H of extraction. However, the latter portion of this discussion, where standardisation of jellying value is considered, is adaptable to juices extracted at any temperature.

Proportion of Fruit to Water

The proportion of fruit to water to use is governed by the hardness of the fruit. The purpose of adding water to fruits should be to allow sufficient cooking time to soften the fruits so that the extracted pectin may be pressed out. There is no value in adding water to some of the soft fruits, but water is required with hard fruits, the larger amounts of water in cases of the citrus fruits involving hard rinds. The proportion of fruit to water should be such that upon pressing over 90 per cent. of the extractable pectin, in terms of sugar-supporting capacity, is removed, making a second extraction uneconomic. The amounts of jellying material extracted should be figured in terms of sugar-supporting capacity for comparative purposes. (Sugar-supporting capacity equals the amount of sugar supported by the total weight of extract.) The viscosity[1,2] is indicative of sugar-supporting capacity when extraction conditions are similar and will be used for calculations of pectic value shown here.

In order to illustrate this point, suppose currants are being examined in the laboratory. The samples taken for examination weigh 454 gm. each. The effect of varying the proportion of currants to water, while subjecting this fruit to a ten-minute boiling extraction, upon the weight, the relative viscosity and the sugar-supporting capacity of the extracted and filtered extract may be seen from the following data:

Fruit Sample (grm.).	*Water Added (grm.).*	*Extracted Juice (grm.).*	*Relative Viscosity of Juice at 80°F.*	*Sugar Supported as a 60% added Sugar Jelly.*
454	—	204	124·0	481
454	227	491	14·6	592
454	454	713	8·5	650
454	681	934	5·6	640

* Approved by C. A. McCue, Director of the Delaware Agricultural Experiment Station.

The sugar (sucrose) supporting capacity of each gram of juice was calculated from the viscosity y according to the formula[1] $\log y = 0{\cdot}8x + 0{\cdot}2$ for a jelly of medium strength[3] (40 cm. water pressure) containing 60 per cent. added sugar. Multiplying by weight of extracted juice gives the total sugar supported (values in last column). The viscosity may be measured by any convenient capillary type of device; the values here are calculated from an instrument known as the Jelmeter and are based on the relative time of flow of water and of juice to the 1/2 mark on this device.

It may be seen from this data that the proportion of fruit to water in the case of these currants should be about 1 : 1. When no water was added, juice of high viscosity was obtained which was difficult to separate from the pulp, the resulting loss of extract accounting for the lowered sugar-supporting capacity. On the other hand, the data show that too large a proportion of water should be avoided.

The ratio of 1 : 1 gives the most economical condition for the extraction of currant juice for jelly from this particular sample. Extraction in this ratio produces a juice which has a viscosity below the standard value of a viscosity of 10 considered in the last portion of this discussion. The proportion of water to fruit to use during extraction to produce approximately a viscosity of 10 in the extract may be interpolated from a curve, as in Fig. 1, drawn from the appropriate data given in the above table. The ratio of fruit to water would be about 100 to 83, as shown by the curve.

Similar procedure would be used in finding the optimum proportions of water to fruit to use in the cooking of fruit, for jams and marmalades. Samples for the viscosity test from cooked fruit for jam or marmalade should consist of juice squeezed from a representative sample of the cooked fruit and filtered before measurement. In this manner a more representative sample showing the pectic value of the cooked fruit may be obtained, assuring the avoidance of a non-uniform set.

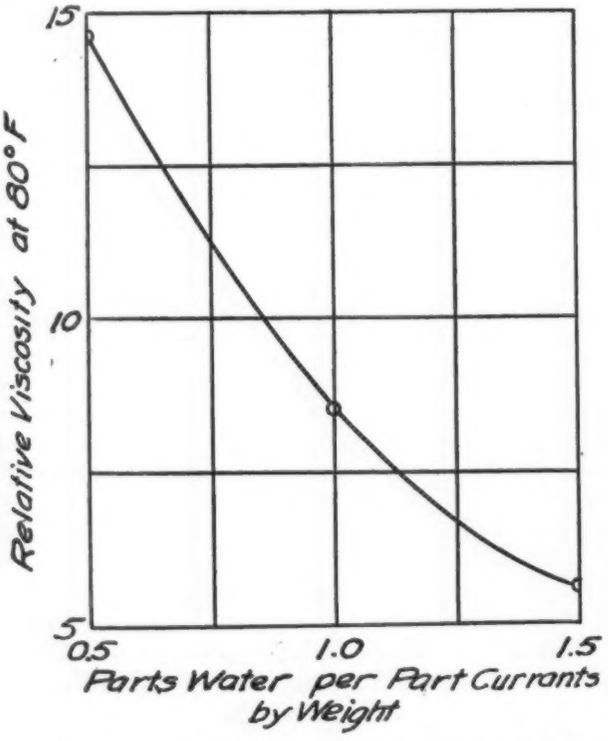

FIG. 1.—Curve showing the effect of varying the proportion of water to currants upon the viscosity of the resulting extracted juice.

Acidity Factor in Extraction

The correct adjustment of acidity for the extraction of maximum jellying material from a certain fruit results many times in great savings. As in the extraction[4] of commercial pectins, the hydrogen ion concentration of the extracting medium plays an important rôle. A hydrogen ion concentration in the extraction medium represented by *p*H 3·0 will convert insoluble protopectin to soluble pectin faster than a medium at *p*H 3·5. In practical manufacture flavour developed upon adding acid should be considered, and manufacturers who once establish correct acidity-fruit relationships upon the varieties of fruits they are using need not worry about resulting hydrogen ion concentration.

An interesting example of the effect of acidity adjustment upon the jellying value of a cooked fruit for jam is found in the case of raspberries. During a seven and one-half minute cooking period at boiling temperature of the crushed berry without added water, raspberries respond to added acid in the manner indicated below:

Fruit Sample (grm.).	*Citric Acid N/1 (c.c.).*	*Cooked Fruit (grm.).*	*Relative Viscosity Juice Sample at 80° F.*	*Sugar Supported as a 61% added Sugar Jam.*
454	—	306	7·2	309
454	15	320	10·0	394
454	30	325	12·3	445
454	45	329	12·2	447

The sugar-supporting capacity of each gram of cooked fruit was calculated from the viscosity y in the formula $\log y = 0{\cdot}65x + 0{\cdot}2$ for a jam of medium consistency containing 61 per cent. added sugar. Multiplying by weight of cooked fruit gives the total sugar supported (values in last column).

From the curve in Fig. 2 and the values shown in the table above, it may be seen that the added acid (30 c.c.) makes available a large increase (almost 50 per cent.) in sugar-supporting capacity over that of the fruit cooked without acid. Since raspberries are generally expensive, any increased jellying capacity is a welcome development. In the case of numerous fruits the addition of acid at the time of extraction appears to develop or increase the fruit flavour in the product. This happened in the case of these raspberries. Thus two purposes were accomplished, more jellying substance was set free and the flavour was apparently increased. The best flavoured jam was made from the sample receiving 30 c.c. of the citric acid which corresponds with high sugar-holding capacity.

The above example is indicative of what may be accomplished with other fruits in the control laboratory. Values once established will be permanent for a factor

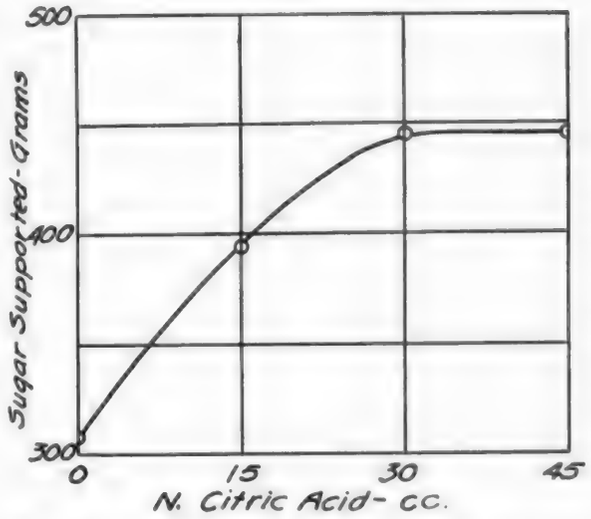

FIG. 2.—Curve illustrating the effect of adjustment of extraction acidity upon the sugar-supporting capacity of the extract.

such as acidity and may be expressed in curve or chart form.

Standardisation of Jellying Value

Standardisation of the jellying value of the extracted juice for jelly or cooked fruits for marmalade by means of viscometric control will assure a more standard product in physical properties and also as to flavour. Any accepted viscosity may be taken for the point of adjustment. A relative viscosity of 10, measured at 80° F., makes a good standard point for the adjustment of viscosity values. If the acidity has been adjusted to the optimum for extraction and flavour during extraction procedure, then a juice for jelly with viscosity of 10 or the strained juice from a sample of cooked fruit for jam with a similar viscosity will produce a product of good physical appearance. A non-varying formula may then be used; for jelly, a fairly firm jelly is produced when using one part of sugar per part of juice and cooking to 66 per cent. soluble solids content; for jam, a jam of good consistency is produced when using the generally accepted 45 : 55 ratio of cooked fruit to sugar. No additional acid need be added because the acid factor should have been adjusted during extraction. More rapid "set" of the jelly product may be accomplished by adding acid to the jelly container if flavour allows this procedure. The above proportions of extracted juice, or cooked fruit, to sugar allow time for sufficient inversion of sugar to take place during cooking to prevent crystallisation in the jelly product.

Adjustment for Juices of Low Pectin Value

Accepting the viscosity value of 10 for the point of adjustment, the correct adjustment for juices with viscosities below 10 may be made by adding a prepared pectin preparation, the amount determined at first by calculation and then corrected by actual experience. (Fruit cooked for jam and marmalade will require only about one half the pectin expected on account of the presence of fruit tissue, etc. Experimental work should be carried out to obtain exact values in order to establish usable curves.) Pectin to be added to juice for jelly may be calculated in the following manner:

Since, according to the formula for sugar-supporting capacity of a fruit juice extraction, $\log y = 0{\cdot}8x + 0{\cdot}2$, when the viscosity y equals 10, the amount of sugar x supported by one part of juice by weight will be 1, then the difference between the sugar-supporting capacity of juice at the lower viscosities and that at viscosity 10 may be made up by added pectin. If a 100-grade powdered pectin (1 lb. supports 100 lb. sugar as a 65 per cent. sugar jelly of 40 units strength) is used, then one hundredth of the weight of the indicated difference in sugar-supporting capacity must be added as pectin. Thus, from the above formula, the sugar-supporting capacity x of a juice at any given viscosity y equals the log of the viscosity minus the constant 0·2, the whole divided by 0·8, or:

$$x = \frac{\log y - 0{\cdot}2}{0{\cdot}8}$$

The difference in sugar-supporting capacity at viscosity 10, which is 1 part sugar to 1 part juice, and the capacity of the fruit juice of viscosity y will equal:

$$1 - \frac{\log y - 0{\cdot}2}{0{\cdot}8}$$

This value, divided by the grade of pectin, in this case 100, will indicate the amount of pectin needed per lb. of juice. If the calculations are based on 800 lb. of juice (approximately 100 gallons) the formula to use would be:

Pounds 100-grade powdered pectin =

$$\frac{\left(1 - \frac{\log y - 0{\cdot}2}{0{\cdot}8}\right) 800}{100}$$

or, simplified, pounds pectin $= 10 - 10 \log y$.

If desirable a table may be easily made up showing the quantity of 100-grade powdered pectin required for the 100 gallons of juice, thus:

Relative Viscosity Juice at 80° F.	*Pounds 100-Grade Pectin per 100 Gallons Juice.*
2	6·99
3	5·23
4	3·98
5	3·02
6	2·22
7	1·55
8	0·97
9	0·46
10	0·0

These values may be plotted as in Fig. 3. When plotted in such a manner easy interpolation of the amount of pectin to be added to juice showing fractional viscosity values is possible. The pectin should be added slowly and stirred in thoroughly; directions for the exact methods of handling a powdered pectin are generally furnished by the manufacturer.

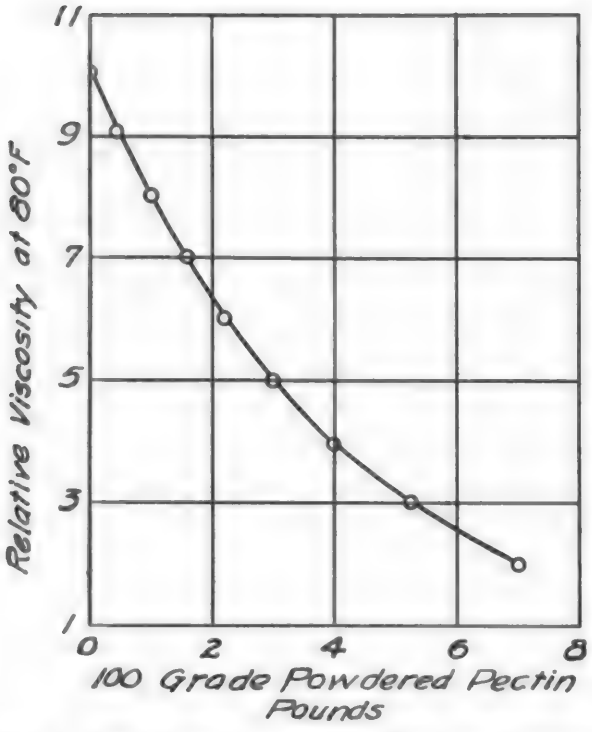

FIG. 3.—Curve showing amount of additional pectin required at various viscosity values to adjust 100 gallons of a juice to viscosity 10.

Once the large batch of juice is adjusted to a viscosity of approximately 10, the jelly may be made up in small batches, 10 or 15 gallons of juice to the batch. A standard amount of juice will require a standard amount of sugar (40 lb. juice, 40 lb. sugar). Cooking of the jelly should be carried out according to weight or temperature in kettles with a sufficiently large evaporating surface to ensure rapid cooking. The finished jelly should contain 66 per cent. soluble solids as checked by the refractometer.

Fruits normally producing extracted juices with low pectic value may be mixed with starch-free, flavourless pomaces[5] previous to extraction. During heating to extract the juice extraction of pectin takes place from the pomace, thereby introducing jellying capacity at low cost. The possibilities in thus introducing pectin from a flavourless high pectic-bearing pomace have not been fully investigated.

Juices of Higher Pectic Value

When juice extracted for jelly has a viscosity greater than 10, dilution with juice of a lower viscosity, rather than dilution with water, will preserve the condition of standard flavour. The amount of juice of each viscosity to use depends upon their sugar-supporting capacity according to the sugar formula given previously. Suppose one extracted juice was found to have a relative viscosity of 14, then its sugar-supporting capacity x, from $\log y = 0{\cdot}8x + 0{\cdot}2$, would equal 1·182 lb. sugar per pound of juice. A juice of lower viscosity, 6, is available for mixing with this juice. The juice of lower viscosity supports 0·722 lb. sugar per pound in accordance with same formula. Allowing the amount of juice with a viscosity of 6, necessary to add to 1 lb. of the juice with a viscosity of 14 in order to adjust the viscosity of the mixture to 10, to equal x, the following calculation should be made:

$$1(1{\cdot}182 + x(0{\cdot}722) = (1 + x)(1{\cdot}0).$$

Or, expressed by words, 1 lb. of the high viscosity juice multiplied by its sugar-holding capacity plus an unknown amount of the juice of low viscosity multiplied by its sugar-holding capacity, equals the weight of the mixture $(1 + x)$ times its sugar-holding capacity, which, of course, will be 1. Upon solving, x will be found to equal 0·65 in this instance. Then for every pound of juice with viscosity of 14, 0·65 of a pound of juice with a viscosity of 6 must be added in order that the viscosity of the mixture will be 10.

When liquid pectin preparations are used to raise the pectic value of an extraction, a calculation similar to the above may be used. Slight dilution of flavour is bound to result, however.

It is only by using methods similar to those in this outline that consistency of strength and flavour may be developed in a manufactured product. Extraction methods, using similar proportions, etc., should first be developed. Once extraction methods are standard, flavour and physical appearance may be kept uniform by viscosity control of the extracted juice or cooked fruit, provided a flavourless powdered pectin is used when needed to build up the sugar capacity. There should be no mystery in such procedure; a constant sugar proportion to the raw fruit taken accounts for consistency in the product.

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RUBBER and FRUIT STORAGE

IN Bulletin No. 6 of the Rubber Growers Association mention is made of the use of rubber in fruit stores. The material used experimentally was a cellular expanded rubber compound, the expansion to a highly cellular form being effected by gas. The result was a very light material which is easily handled. The degree of insulation given is excellent and compares favourably with that of cork.

Provided that this product can be produced commercially, there appears to be a great future for it. Where cork chips or dust are objectionable, the new cellular rubber might well be substituted; the Spanish civil war is likely to leave its mark on the cork trade of the world for some time to come, and this new product may help to relieve a world shortage.

RESEARCH AT THE IMPERIAL INSTITUTE

THE IMPERIAL INSTITUTE is well known for the research work it carries out upon commercial problems, especially in connection with Empire products, and the *Bulletin*, vol. xxv, No. 1, which we have just received, shows that this good work is being well maintained.

Granadilla (Passion Fruit) Seed Oil

There is an increasing demand for passion fruit juice, and at the Ideal Home Exhibition this year there was a passion fruit milk cocktail bar. This is causing attention to be focused on the seeds of the fruit, which are at present a waste product. A sample of the seed was sent to the Imperial Institute from Kenya, and it was found that there would probably be a market for this oil at a price of about £30 per ton.

It would not be economical to export the seed as an oilseed, owing to the high percentage of waste, but if the oil could be extracted in sufficient quantities in Kenya, or elsewhere where the passion fruit is found, there would probably be a market among soapmakers and paint manufacturers. The residual meal cannot be considered a commercial product.

The New Guinea Coconut Industry

Reference is made in the *Bulletin* to an article in the *New Guinea Agricultural Gazette* by R. E. P. Dwyer, Economic Botanist to the Department of Agriculture, reviewing the position of the coconut industry in the Mandated Territory of New Guinea. This industry, by far the most important in the Territory, suffers from lack of organisation and co-operative effort. Some system of centralised research and control is called for, so that it may be ascertained which plantations are being worked economically and which are not. In many places the soil is exhausted owing to years of continuous cultivation, and there is also much room for improvement in the copra manufacturing methods. It is therefore hoped that in the near future a thorough economic and scientific survey of this important industry will be undertaken by competent authorities. Side by side with the copra industry is another small but established activity, the manufacture of shredded and desiccated coconut. In 1935 the output of the three factories exporting these products was 1,611 tons.

It has also been suggested that there is a market waiting in the East for the enterprising person who will undertake the manufacture of coconut oil in New Guinea.

[*The photographs on this page are reproduced by courtesy of the High Commissioner for New Zealand.*]

Harvesting passion fruit on a North Auckland, New Zealand, plantation. The juice of this fruit is being imported into this country in increasing quantities, mainly from Empire sources.

The fruit is brought to this factory in boxes, and in the picture the pressing operation is in progress. The juice is packed in bottles (seen to the right of the picture) and is then ready for export.

ANALYSIS of FEEDING STUFFS

Quantitative Microscopical Determination of Rye, Wheat and Barley Starches in Ground Oat Mixtures. By T. G. A. Griffiths, B.A., Ph.D., A.I.C.

In a paper given before a meeting of the Society of Public Analysts on April 7 the author described an extension of Wallis's "lycopodium and starch grain" counting method by ascertaining the ratio of starch grains with characteristics of diagnostic value to the total number of starch grains present. Such characteristics, for example, are the stellate hilum of rye starch grains, and the large diameter of some rye starch grains as compared with the diameters of the starch grains of wheat and barley. For greater accuracy in counting the small proportions of large starch grains in a mixture a microscope projector technique has been devised.

Analytical Control in JAM MANUFACTURE

(Specially Communicated)

THE FACTORY preparation of jams and jellies probably lends itself better than the majority of food products to chemical control, and although, in order to produce high quality products, it is still of prime importance to engage the services of an expert jam boiler, the ultimate control is now usually handled by the chemist. It frequently happens that it is not practicable to engage the full-time services of a chemist, and in such cases regular analyses are usually performed by a public analyst or consultant. By this means the manufacturer is able to check up on his production from time to time, and in between analyses he manufactures according to rule of thumb methods, only altering his procedure when analysis shows this to be necessary.

However, as with many other sections of the food industry where the raw material is of fruit or vegetable origin, and is therefore subject to differences due to climate, conditions of growth, and other causes, it is most desirable that very frequent analyses should be made. Without doubt the chief purpose of chemical examination of jams and jellies is to ensure the absence of troubles, such as mould, fermentation and crystallisation, which will ultimately cause the product to be returned to the manufacturer, with a consequent loss of goodwill. This function of analytical control is of far greater importance than any savings in material, which may also result from the use of accurate figures of analysis.

The Interpretation of Analytical Figures

In the ordinary routine manufacture of jams and jellies there is no doubt that, in order to get the most out of analytical figures, it is necessary to have someone on the spot who can make quick and accurate routine tests, since, in the average factory, boilings are completed with such rapidity that a considerable amount of incorrectly made jam may find its way into the packing department by the time the fault is found out.

It is not necessary for this work to have a fully qualified chemist, but there should be present, all the time, someone who can interpret these results and make full practical use of them. For instance, suppose that, on account of an unusually acid cask of fruit, the percentage of invert sugar in some jam were found to be 40 per cent., it would be beyond the knowledge of the average person doing such routine work to make even an approximate guess as to what alteration in boiling time or amount of added acid, in the form of citric or tartaric, should be made in order to reduce the amount of invert sugar to a reasonable level of say 27 per cent. A knowledgeable person of considerable experience in jam boiling is therefore essential.

In the ordinary way the jam manufacturer desires security from the following well-known troubles: (1) Mould growth, (2) fermentation, (3) crystallisation or granulation, and (4) contravention of the law.

Mould Growth

In order to avoid trouble from mould growth the main figure to watch is the percentage of soluble solids. The acidity and the amount of residual sulphur dioxide (if any) also have an influence on this, but in the main the soluble solids is the governing factor.

The most practical way of ascertaining this is by the use of a suitable refractometer, such as the Abbé instrument, which reads directly in percentage of soluble solids. A satisfactory figure is usually considered to be 72 per cent., but different manufacturers have different ideas as to the actual safety limit. It is an easy matter for even an unskilled person to determine in a few minutes the soluble solids by means of such a refractometer, but supposing a figure is obtained which is considered to be beyond the limits laid down as satisfactory, it requires a person of some experience in jam manufacture to make the necessary corrections.

To give an example, supposing the working limits at a particular factory were 70·5 to 72 per cent., and that one particular boiling was found to contain 74 per cent. of soluble solids, this might be caused by one of several factors. In the first place, too much sugar might have been added by error, or a new cask of fruit pulp may contain considerably more natural sugars than the previous cask; on the other hand, boiling may have been continued for too long a period, or the temperature may have been too high (possibly due to a change in atmospheric pressure).

All these possibilities have to be considered and, if necessary, further analyses of the sugar syrup or fruit itself carried out. A good practical man would, by checking up the final weight and by correcting the boiling point for any change in atmospheric pressure, be able to judge fairly correctly where the error had crept in.

Fermentation

Again, the control of the soluble solids is of major importance, although an examination of pulp or fresh fruit under the microscope, in order to detect the presence of undue numbers of yeasts, is also an advisable precaution.

Granulation and Crystallisation

It has been mentioned above that both of these are caused by an incorrect ratio of invert sugar to cane sugar. Granulation (*i.e.*, dextrose granulation) is due to the presence of an excess of invert sugar, and it generally does not take place when the percentage of invert sugar is below about 30 per cent. Crystallisation (*i.e.*, sucrose

crystallisation), on the other hand, is due to too great a proportion of cane sugar or, considered the other way round, to too little invert sugar. Crystallisation may occur when the invert sugar falls below about 20 per cent., so that, broadly speaking, in order to avoid these two types of crystallisation, the invert sugar should fall between 20 and 30 per cent., many jam manufacturers aiming at a figure of about 28 per cent.

Of all the variations which may occur in jam boiling, one of the most likely is the quite appreciable difference in invert sugar between one batch and another. Obviously, therefore, it is essential that frequent invert sugar tests should be made, and again it is the interpretation of these results which is the most difficult. The changing from, say, one cask of fruit to another, with consequent difference in active acidity ($\not{p}$H), may cause a very considerable rise or fall in the percentage of invert sugar, even when the time of boiling and temperature are kept constant.

Experience alone can provide the means of arriving at the best method of correction. For instance, supposing a boiling of jam were found to contain only 18 per cent. of invert sugar, whereas previous boilings made under the came conditions contained 28 per cent.; it might be advisable to add a certain amount of extra water to the boil in order to increase the boiling time, finishing, of course, at the same weight as before. Alternately, it might be preferable to reduce the amount of citric or tartaric acid, or to add these acids at an earlier stage in the boiling.

Contravention of the Law

In addition to the agreed requirements for jam as laid down by the Food Manufacturers Federation (to which there should be no difficulty in complying by any manufacturer of repute), the question of the amount of sulphur dioxide present is one which requires careful attention. Of course, there is no difficulty with jams made directly from the fresh fruit, but certain varieties of jam—notably black currant—which are made from fruit pulp preserved with sulphur dioxide, are liable to contain an excess of sulphur dioxide in contravention of the Public Health (Preservatives, etc., in Food), Regulations. This states that the maximum permitted amount should be 40 parts per million.

A careful check, not only on the finished jams, but also on the sulphited fruit pulp itself, should be made, and if an excessive amount should be found, some means of reducing it must be evolved. The jam boiler may decide to use a proportion of fresh or canned fruit in order to overcome the trouble, or, alternatively, he may increase the water to prolong the boiling period and so boil out more of the SO_2. By adopting this latter course, however, care is needed to see that the invert sugar balance is not upset, and after any alteration in the amount of water, subsequent checks should be made on the invert sugar in order to ascertain how far the balance has been disturbed.

Other Factors to Consider

So far the question of analysis in the routine factory control of jam manufacture has been considered, but, in addition, there are many ways in which analytical figures may prove to be of the greatest importance. For instance, it sometimes happens that difficulty is experienced in making a particular batch of jam set correctly, and the cause of this may be quite obscure. A check on the $\not{p}$H or the titratable acidity may show up the reason for sticky jam, whilst a test (by making up a jelly with sugar and acid under standard conditions) may show that the pectin which is being used is at fault. Analyses of finished jam as regards pectin content may sometimes be misleading, as the chemical determination of pectin does not always show the gelling power. In this case, therefore, an analysis may show a reasonable amount of pectin to be present, but the fault may lie in the fact that this pectin is in a slightly modified form possessing less gelling power. Gel tests under standard conditions are therefore the best means of assessing pectin.

In recent years a considerable amount of work has been published concerning the chemical composition of fruits, and this knowledge has opened up another field of usefulness for the analyst. It is now possible, within reasonable limits, to determine the percentage of fruit present in a jam, and although, naturally, the manufacturer would not be particularly interested in such figures for his own jams, it is often of use, in making a survey, to be in possession of such information.

In addition to the above, chemical analysis may be instrumental in effecting savings in the purchasing of raw materials and also in the manufacturing procedure in the factory. Such products as pectin, colouring matters, etc., can be purchased on a strength-for-price basis, and not only can the most economical choice be made but regularity in the finished product can be assured.

To sum up, by far the most important and essential use of analytical control of jam manufacture lies in the control of quality, thereby not only ensuring a uniform product but obviating the risk of complaints arising from such troubles as fermentation, crystallisation, etc. Any saving which might result from chemical control of raw materials and processes is of a secondary nature but nevertheless important.

DETERMINATION of PECTIN

In connection with Enquiry No. 2,083, which was answered in the March number of Food Manufacture, p. 101, Mr. George L. Baker, of the University of Delaware Agricultural Station, U.S.A., author of the article in this number on the "Extraction and Standardisation in Fruit Jelly Manufacture," writes to point out that though the use of the Carre-Haynes method of determination of pectin content is correct for the quantity of pectin, it gives no measure of the "gelling" capacity. He suggests the use of the viscosity method being utilised successfully by manufacturers in the U.S.A. Mr. Baker also mentions that several readers of Food Manufacture, following the methods outlined in his article published in our December, 1934, number, p. 427, have written to him of their success.

VITAMINS IN CANNED MILK

An investigation into the problem of vitamins in canned foods is going on at the present time in Switzerland, especially as concerns the vitamins to be found in canned milk. The ordinary processes of condensed milk manufacture appear to destroy to some extent the vitamins, and it is submitted by certain manufacturers that it is not possible to obtain a dried or condensed milk containing sufficient vitamins to supply all the necessary vitamins to a baby fed entirely on such milk.

With the growth of the manufacture of vitamins it is now possible to obtain certain of these in suitable form at relatively low prices. Nestlé, for example, prepare in

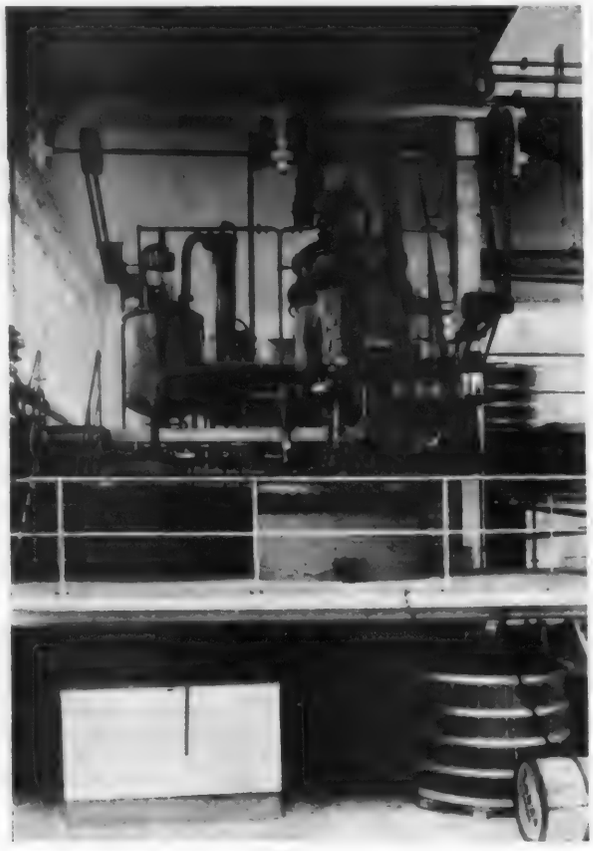

Fig. 1.

Fig. 1.—Industrial preparation of ascorbutic acid in the Hoffman La Roche plant at Basle, Switzerland. Plant for the extraction of sorbose and its treatment with acetone; extraction and filtration are carried out under pressure.

Fig. 2.—This picture actually shows the apparatus in which sorbose is changed into 2-keto-gulonic acid. The mixers above are connected by filters to the centrifugal hydro-extractors below.

Fig. 3.—The installation in which the 2-keto-gulonic acid is converted into ascorbutic acid. On the left is an autoclave, and on the right a closed, jacketed vessel fitted with an agitator. Note the spherical shape of the latter vessel for operation under pressure.

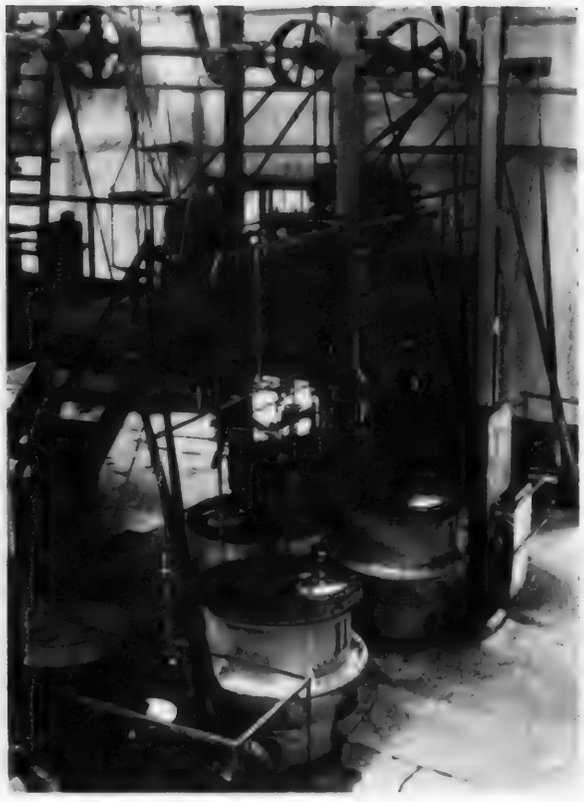

Fig. 2.

Fig. 3.

Switzerland a milk known as Nestrovit, which is an ordinary condensed milk to which after preparation a quantity of vitamin C has been added.

The quantity is chosen so that the milk is a hypervitaminised product containing more than the normal amount of ascorbutic acid. It is used by adding a small quantity—say, a teaspoonful—to the ordinary dose of condensed milk every day, and it is claimed that it has the advantage over normally vitamised milk that in special cases it permits hypervitaminised feeding of the baby. (Of course, this should only be done under strict medical supervision, as this journal has emphasised on more than one occasion.) It also permits preparation of the milk in the ordinary way with hot water, the extra spoonful of Nestrovit being added *after* the milk has cooled.

Preparation of the three other most important vitamins, A, B_1, and D, is now becoming sufficiently advanced to permit their use economically in the preparation of other vitamin corrected foods.

But the question of making hypervitaminised foods on a considerable scale for sale to the public will have to be examined very carefully. Indeed, there are some in this country who would go so far as to say that their manufacture ought to be severely restricted, if not prevented. The medical use of vitamin concentrates is, however, another matter altogether.

To give some idea of the scale on which vitamin substances are being manufactured, we are reproducing on page 154 pictures of a plant in operation in Switzerland for which we are indebted to Hoffmann La Roche of Basle.

OPTICAL DEVICES and APPARATUS

Various Instruments useful in Food Manufacture

THE exhibition held at Birmingham University, March 18 to 20, in connection with the second Conference on Industrial Physics, organised by the Institute of Physics, provided an opportunity to examine a wide range of optical apparatus, many examples of which are extensively used in the control of food manufacturing processes. A review of the apparatus most interesting to food manufacturers is, therefore, opportune.

A colour comparator, shown by the Research Laboratories of the General Electric Co., Ltd., is a simple instrument designed for the determination of colour between certain limits. Three Osira laboratory lamps were also shown on this stand. These are small hot-cathode lamps, and the sodium lamp exhibited gives practically monochromatic light suitable for sugar polarimeters, etc.

E. Leitz (London) made a big display of instruments, some of which were concerned with colorimetry. The Leifo photometer is specially interesting. In this instrument light obtained from a source is split into two beams by means of a silvered prism. One beam goes through the test liquid and thence into the comparison eye-piece, and the other goes through two Nicol prisms which are used for varying the intensity of the light. The Nicol prisms are adjusted until a colour match is obtained, and the angle between the prisms is a measurement of the colour tested. Other colorimeters shown on this stand were simple Duboscq, two-stage and three-stage models with arrangement for absolute colorimetry without standard solutions with the help of the universal grey filter solution and monochromatic filters.

The exhibits of Carl Zeiss (London), Ltd., were very interesting. The Pulfrich photometer is a universal instrument for colorimetry without a comparison solution, and the fields are set to equal intensity, and not equal colour impression, so that the personal colour equation is eliminated. This instrument is largely used in *p*H determination. Refractometers shown included the Abbé and a compact model with temperature control specially designed for sugar and oil industries.

Bellingham and Stanley, Ltd., showed a latest type projection refractometer. A continuous flow cell has been designed for use with this instrument, thus rendering it suitable for control of products during manufacture. A temperature correction drum has also been designed as an optical fitting for sugar work. A glass circle polarimeter, exhibited by this firm, is designed with a divided circle and verniers of glass, to be read by transmitted light.

A photo-electric comparative colorimeter was shown by the Salford Electrical Instruments, Ltd., and cells for standard liquid filters used in colorimetry by the National Physical Laboratory.

On the stand of Adam Hilger, Ltd., there was the Barfit intermediate quartz spectograph. Measurements of the absorption spectra of liquids and solutions yield useful information; for instance, the concentration of vitamin A in a fish-liver oil may be determined from a measurement of the depth of an absorption band in the ultra-violet. The Spekker ultra-violet photometer is used for this, and a model was shown in conjunction with an intermediate quartz spectrograph. The Hilger Vitameter A provides a means of making this measurement, by fluorescence. Other exhibits on this stand included the Hilger Barfit polarimeter and the Hilger Abbé refractometer.

Tintometer, Ltd., displayed the well-known Lovibond Tintometer, phosphatase comparator, Lovibond Nesslériser and Lovibond Comparator, and also a special cubicle for colorimetric instruments.

Several microscopes shown by Charles Hearson and Co., Ltd., included the Reichert new large universal microscope 2 (a high-precision instrument with inclined binocular or monocular tube for direct observation) and the Reichert universal microscope MeF (a compact bench instrument combining microscope and reflex camera).

Among the interesting lectures and discussions during the Conference there was "Colorimetry, Spectrophotometry and the Inspection of Manufactured Products for Appearance," opened by R. Donaldson, M.A., of the National Physical Laboratory, and "Polarimeters, Saccharimeters and Refractometers in Sugar, Jam-boiling and other Industries," opened by L. Eynon, B.Sc., F.I.C., of Messrs. Eynon and Lane, official analysts to the Sugar Association.

Contamination and Spoilage in the Cannery

Methods of Prevention and Control

By A. Samson, A.R.C.S., A.I.C.

TWO ASPECTS of this subject will be discussed—namely, fruit canning and vegetable canning—for the reason that the types of contamination are different in the two cases, although they may both lead to spoilage. The character of the spoilage may, however, be different.

FRUIT CANNING

In the case of fruit canning we need not fear very much the effects of bacteria, as the acidity generally present in canned fruit is capable either of destroying the bacteria and their spores or else of rendering them inactive. What are feared most in fruit canning are yeasts and moulds. Of these, yeasts produce the greatest effect prior to the actual canning of the fruits, whereas the moulds are dangerous both prior to and subsequent to actual canning.

At the end of the summer packing season many canneries close down during the winter months until the return of the next period. On the other hand, many canneries function, but fail to use—during the winter months—much of the equipment which comes into action during summer canning. It is well to bear in mind that equipment allowed to remain idle over long periods may be a serious source of contamination and spoilage when the new packing season commences. In view of the imminence of the 1937 canning season, consideration of possible sources of such contamination is advisable.—ED.

Of course, in this discussion of the problems of fruit canning it is assumed that the processes of sterilisation are such as will take care of the normal numbers of micro-organisms generally associated with the different fruits. Yeasts and moulds form spores, and there is no doubt that all fruit brought to the cannery is, to some extent, contaminated with such spores. The efficiency of the cannery organisation will determine whether these spores will gain an upper hand, producing either inferior quality articles or spoilage, or whether they will be destroyed.

Points where Damage Occurs

In the passage of fruit through the cannery there are many points where the fruit remains stationary, or else comes into contact with the various articles of equipment. It is at these points of rest or contact where great damage can be done, in the form of growth of undesirable organisms or increased contamination. It was stated previously that many factories and many pieces of equipment remain idle from one season to another. If this equipment is not thoroughly cleaned immediately after canning and prior to the commencement of the new season, there is certain to be heavy contamination of the new season's fruit. Yeasts and mould spores will be transferred to the fruit with consequential danger of spoilage.

There are innumerable pieces of equipment wherein the countless numbers of harmful spores can lie; and the moment they settle on the fruit, particularly on soft fruits, they begin to vegetate and so make successful processing more difficult. Fruit trays stained with fruit juices and dust are serious contaminating sources. They should be either steamed at 212° F. or else thoroughly washed in hot water containing chlorine disinfectant and then rinsed. Mere washing with a brush and warm water—as is done in many factories—is useless and, in fact, dangerous.

In the case of soft fruits it is advisable to see that clean paper is placed between fruit and tray and fresh paper should be used for each delivery.

Washing machines should be carefully examined for decayed fruits left over from the previous season. Grading machines should be stripped and cleaned. Fruit conveyors and rubber belts should be thoroughly washed with hot water and then hosed down. Fruit packing tables require washing with water containing chlorine disinfectant. They should then be rinsed or hosed down with fresh water. All pails, trays, buckets and similar utensils should be washed and then steamed. Steam of a temperature of 212° F. applied for half an hour will be sufficient to destroy yeast and mould spores.

Can-seaming machinery also requires attention, especially the pads on the plungers. Bits of fruit will be found on syruping machines in corners or inaccessible parts. These machines should be washed with hot water and then hosed down.

Metallic Contamination

Another form of spoilage that may occur in canned fruits arises from the use of metal containers fabricated from material which cannot be considered strictly corrosion-proof, the obvious remedy for which is to replace them with containers made in a non-corrosive material, such as stainless steel, nickel, or monel metal. But if this is not immediately possible, all such vessels should be thoroughly examined for rust, and, in the case

of copper vessels, for verdigris. As many fruits are seriously affected by the presence of these minute proportions of iron or copper, all pipe work should be completely dismantled, thoroughly cleaned by blowing through with steam and water, and then reassembled.

Because of the effect of these metals on the colours of certain fruits, a thorough overhaul of all equipment should be made in order to eliminate any possible sources of metallic contamination. Cooling tanks, for example, should start the new season in a scrupulously clean condition. There are times when the seams of cans are not as tight as they should be, and when the hot cans—after processing—are placed into the cooling tanks or coolers there is a possibility of the cooling water being drawn into the seams. If this cooling water is in a dirty bacterial condition, any such contamination may be passed through to the contents. Spoilage is the result.

Until the fruits are actually sealed in the cans and processed, they may be looked upon as living organisms, subject to change and decomposition. This is especially the case during summer with soft fruits. Owing to the large amount of moisture present in these fruits and the prevailing high temperatures, decomposition due to enzymes, yeasts, or moulds sets in very rapidly. The decomposition is not immediately apparent, nor is it an easily observed condition. Sometimes this decomposition or deterioration is increased by the conditions of storing in the cannery, where there may be dirty or overheated, ill-ventilated sheds, dirty walls and ceilings harbouring mould spores. It is really advisable to re-paint or whitewash all walls and houses before the new season commences. Cold or cooled stores should be disinfected—chlorine again being one of the best disinfectants.

All diseased and mouldy fruit should be removed as quickly as possible to a position far from the factory and burnt. Observance of these details will help the canner produce sound quality canned fruits, with the minimum of spoilage.

VEGETABLE CANNING

In the canning of vegetables and a discussion of the spoilage of such products it is essential to realise that we are dealing with entirely different types of organisms from those associated with fruit canning and spoilage.

Yeasts and moulds and their spores have little influence in vegetable canning. The organisms of importance are the bacteria, both sporing and non-sporing. Generally speaking, the non-sporing types may be looked upon as the primary cause of trouble prior to actual sterilisation, whereas after sterilisation the sporing organisms are those to be most feared.

It is a significant fact that most of the organisms associated with the spoilage of canned vegetables are very heat-resistant. They all produce spores which are destroyed with difficulty. Temperatures of sterilisation must of necessity be high, and it is this fact which makes it all the more important and essential that vegetable canning be carried out under as clean conditions as possible. The conditions are rendered more difficult by the fact that most vegetables are poor conductors of heat. They mat in the can, like spinach, or produce viscous fluids impeding heat transference, like processed peas. Moreover, canned vegetables, on account of their low acidity, provide a fairly good medium for the very bacteria generally associated with these products.

It can, therefore, be appreciated that there are sufficient numbers of organisms associated with the different vegetables to be canned to warrant the most careful supervision and control without the added anxiety caused by further bacterial increments due to causes which can be easily controlled. The dangerous organisms associated with vegetable canning are the anaerobic and the thermophilic types. Both of these are spore-formers and are found in soil, dirt and similar conditions. It is, therefore, reasonable to expect that the existence of such conditions in the factory will tend to increase the chances of spoilage.

Plant Responsible for Contamination

In vegetable canning a great deal more plant and equipment is used than in the canning of fruits, and it has unfortunately been proved that much of the equipment used has been responsible for increasing the bacterial contamination prior to sterilisation.

Juices and liquids or drained water from vegetables may contain millions of organisms per cubic centimetre. These liquors tend to lodge in out-of-way parts of equipment where they act as a continual source of contamination. Automatic blanchers are an excellent example of the type of plant affected. All tanks, hoppers, trays, bins, belts, etc., should be thoroughly scoured and washed and then sluiced with clean water. Blanching machines cannot be given too much attention. Wood ought to be kept out of vegetable canning. Wooden equipment of any sort is dangerous, as it so readily harbours the spores of the organisms previously mentioned.

Care in Canning Peas

Vegetables should be dealt with as rapidly as possible. Canned peas constitute the greatest individual pack of all canned vegetables produced in this country, and I propose to deal at some length with this particular article. To can peas successfully there must be available an abundant supply of clean water. Peas cannot be washed too much prior to canning. Whether podders or viners are used, these machines should be thoroughly cleaned before the new season commences. Very often the vined or podded peas are transferred to the cannery proper in "lug" boxes. They may be made of wood or galvanised iron; the latter type is much to be preferred. The "lug" box should be constructed of well-galvanised metal with small perforations in the bottoms and the sides; these perforations will allow the movement of air through the bulk of peas and so prevent overheating; in any case, before each lug box is filled with a fresh supply of peas it should be properly washed with fresh water.

The moment the peas enter the cannery they should be rushed through the process as rapidly as possible, making contact with fresh water almost continually. Care should be taken that the pea cleaners, washers and graders are always kept clean, and that if any machine breaks down the peas should be kept in cold water. The constant contact with cold water helps to keep the peas cool, so

preventing enzymatic changes; also to remove the mucus-like material which not only imparts an undesirable flavour to the canned article, but also helps to retain bacteria on its sticky surface.

As the blancher is a possible source of contamination it is most helpful to wash the peas after they have been blanched. It has been proved in America that some sugars are a principal source of thermophilic organisms. Similar conditions have not been found in this country; probably the sugars here are in a much purer form; nevertheless, it is quite possible that thermophilic organisms may find their way into the cans. The surest method to prevent their development, with consequent spoilage, is to lower the temperatures of the canned vegetables, after sterilisation, below the optimum temperatures of the organisms—that is, about 55° C. or 130° F. It is, therefore, imperative to cool the cans immediately after sterilisation, and to cool them sufficiently. It is also imperative to stack the processed cans so that any residual heat has an opportunity to be dispersed, and not allowed to remain in the interior of the stacks, producing stack-burn and thermophilic development.

During the canning season atmospheric temperatures are high and conditions are most favourable to the growth and multiplication of bacteria. It is highly dangerous to pack the warm processed cans of peas or other vegetables into the cases which are to be stacked in the warehouse. This is the surest way to develop thermophilic spoilage.

Metallic Contamination of Vegetables

Canned vegetables are very sensitive to metallic contamination, particularly iron; most of the vegetables possess a small sulphur content, and this, together with any iron present as a contaminant, produces dark iron sulphide. Canned peas can easily be spoiled and the liquor darkened by the presence of such sulphide, also celery, turnips, and potatoes. Another contaminating metal is copper, which also produces dark-coloured sulphides with high staining power. All equipment should be free from iron or copper exposure; in this respect it is a good plan to flush the whole of the plant with clean cold water for several minutes before canning operations are commenced. This will help to minimise considerably bacterial and metallic contamination.

One aspect of vegetable canning has not yet been considered. The cans themselves can harbour large numbers of organisms caught up during fabrication, storage, transport, and other ways. To ensure a thoroughly clean pack, all cans should be washed prior to being filled. No emphasis need be placed on this aspect.

It will be seen that a clean factory will help considerably to produce a clean, safe product. No raw material ever enters any cannery sterile or free from contamination, but this contamination of raw product can be of secondary importance to that which can develop in an unsatisfactory, unclean, and badly organised cannery. Badly cleaned equipment can be a dangerous source of bacterial contamination. It is a poorly organised cannery that resorts too frequently to disinfectants. The best method of control is to destroy the organisms originally present, and prevent any fresh organisms vegetating on the foodstuffs.

It cannot be over-emphasised that one of the surest methods to attain success is the liberal use of fresh cold water—at the end of the day's work and before the work commences.

Every canner ought to consider how much he suffers financially through spoilage, inferior quality, returned goods, and similar avenues of lost revenue, and then weigh up if it is worth his while carrying into effect the suggestions outlined.

REMOVAL of STARCH from APPLE POMACE

In a recent bulletin Dr. G. L. Baker (*Delaware Agr. Exp. Sta. Bull.*, **204**, 1936) describes a detailed investigation of methods of removal of starch from apple pomace prior to the extraction of pectin. Pectin extracts sometimes contain nearly as much starch as pectin; a very undesirable feature if the pectin is intended for the preparation of jellies, because the starch causes turbidity and haziness in what should be a bright, clear product. Attempts have been made to remove the starch from such extracts by treatment with enzyme preparations, such as taka-diastase, prior to concentration of the pectin. This involves the assumption that the enzyme digesting the starch has no effect on the pectin, an assumption which in the case of most active enzyme preparations was found by Baker to be incorrect because of the presence of contaminating pectic enzymes.

At the same time, the hydrolysis of the starch was found to be considerably retarded by the pectin in the extracts. The optimum conditions for starch removal are reached at a temperature of 30° C. and with the hydrogen-ion concentration between *p*H 3·2 and 3·6. Because of the accompanying attack on the pectin, which may reach serious proportions, and the necessity for accurate control of *p*H, etc., Baker prefers instead to pre-treat the pomace so that the amount of starch passing into the extract is much reduced. This may be done in various ways according to the condition of the pomace. Ordinary leaching of finely ground, dry pomace with water at 30° C. is relatively ineffective in the removal of starch, but brief heating in water at 80° C. renders the starch particularly susceptible to the action of diastatic enzymes, so that if it be followed by quite a short enzyme treatment, a matter of minutes only, the starch is extensively removed and subsequent pectin extracts are clear and bright. Fresh pomace can be leached and treated in a somewhat similar manner, preferably being partially dehydrated with alcohol or other solvent, before drying. From the latter material pectin extracts of particularly high quality are obtainable directly, and the treatment involves no loss of jelly units.

The elimination of the starch from the pomace prior to the extraction of the pectin seems to have distinct advantages both in the quality and yield of product and in the ease of operation.

SCIENCE and the CONSERVATION of FOOD

Some Special Problems discussed by Mr. T. Macara, F.I.C., Director of the British Food Manufacturers' Research Association, before a Meeting of the Royal Institution on April 16th

WHILE THE term "conservation of food" may be applied to many aspects of the production and handling of foods, the lecturer confined himself to problems connected with some common types of manufactured food and used these to illustrate a number of the scientific principles underlying the preparation of foods in such a manner that they will keep in a sound and saleable condition, without the use of preservatives. Before dealing with the selected problems, however, he first enumerated the various agencies, biological, physical and chemical, which render food unfit for consumption or else merely unsaleable without being deleterious to health.

Jam Manufacture

The first problems discussed were mould growth and fermentation, crystallisation and absence of jelly property in jam. As regards mould growth and fermentation he put forward the theory that their prevention depends on the production of a jam having a higher osmotic pressure than that of mould spores or yeast cells, and he showed how this result could be achieved. Crystallisation of sugars, or "graining," was explained during a brief account of the chemistry of the subject, in which it was shown how the manufacturer is able to overcome these defects. The jelly property of jams is due to the fruit pectin, and it was shown how the jellifying of this pectin may be lost or destroyed through lack of knowledge of its properties.

Canning and Preservation

Mr. Macara then discussed problems connected with the preservation of fruits, vegetables, and meat products. He pointed out that the British Food Manufacturers Research Association had found certain bacteria whose spores showed an extraordinary high resistance to heat. Boiling for 8 hours or heating to 230° F. for an hour failed to destroy them. These times, of course, applied to small quantities of materials, so that when larger quantities had to be sterilised it was necessary to know the rate at which heat penetrated the product. The method of determining this was illustrated and explained. Some illustrations were given of the times necessary for the centre of certain commercial products to reach the desired temperature. The difficulty of obtaining cans free from defects in the coating of tin was also mentioned. A number of cases had been met with where the cans became perforated after 3 or 4 months' storage.

Chocolate and Confectionery

Some of the defects occurring in chocolate and confectionery, Mr. Macara said, were due to atmospheric conditions, particularly as regards temperature and humidity, and others to the manner in which the fat in chocolate had crystallised.

The lecture was illustrated with lantern slides and a demonstration was arranged to show some of the setting properties of pectin. There were also a number of exhibits in the library, including scientific apparatus used in factory control and research.

SOUTH AMERICAN COW TREE

A BULLETIN which has come to our hand from the Royal Botanic Gardens, Kew, contains an account of wax-yielding plants, of genera or species which are known to yield wax in fair quantity or have actually been utilised by man in some part of the world for the production of wax for his own needs.

Brosimum, a so-called wax, is obtained from *Brosimum Galactodendron* D.Don, the cow tree of the South American forests, particularly prevalent in the forests of Venezuela. This tree is of large dimensions, reaching a height of 100 feet with a base diameter of from 6 to 8 feet. Incisions are made in the trunk and a latex or sap is obtained which somewhat resembles cow's milk, being used as an article of food by the inhabitants.

When this sap or milk is boiled, a yellowish white resinous material separates out, which is of soft consistency and somewhat transparent when fresh. Its superficial resemblance to beeswax may have earned for it the name of cow-tree wax. Actually the material consists mostly of resin, and it has been considered for chewing gum manufacture.

This interesting picture from South Africa gives some idea of the scale on which sun-drying of deciduous fruit is carried out in Cape Province. (By permission of South African Railways and Harbours.)

INDUSTRIAL NEWS

New Director for McDougalls

Mr. Robert McDougall retired from the board of directors of McDougalls, Ltd., the well-known manufacturers of self-raising flour, on March 31. Mr. McDougall wishes to reduce his business activities owing to indifferent health, but he is retaining his seat on the board of McDougalls Trust, Ltd.

The vacancy on the board of McDougalls, Ltd., has been filled by the appointment of the company's chief chemist, Mr. T. H. Fairbrother, M.Sc., who is well known to the readers of FOOD MANUFACTURE as a contributor on cereal chemistry.

Mr. Fairbrother gained first-class honours in chemistry at Manchester, and was a Prizeman in Practical, Physical, Advanced Organic Chemistry, Metallurgy and Bacteriology. He gained the Leblanc Medal in Technological Chemistry and carried out research work on Explosion Waves and Explosives.

He was requisitioned by the Ministry of Munitions during the war and later became chief chemist and works manager of His Majesty's factory at Lytham.

After the war, he became head of the manufacturing department of the British Dyestuffs Corporation and later took over the headship of the Fine Chemical Department of the B.D.C.

In 1927 he was appointed chief chemist to McDougalls, Ltd., and in connection with his work here he has carried out much research work on foodstuffs and cereal chemistry.

Sir Edgar Jones, Simonite Candidate for Carmarthen

Sir Edgar R. Jones, chairman of the National Canning Council, has been adopted as prospective Liberal National candidate by the newly formed Carmarthen Division Liberal National Association. He represented Merthyr as a Liberal from 1910 to 1922.

Sir Edgar Jones, in his address to the association, said the supreme task was that of maintaining peace for this country, for the Empire, and for the world.

Press Button "A" for—Salt

The labour involved in the use of pepper and salt is lightened by a recent American invention. Owen Cragg, of Detroit, has produced the automatic pepper and salt shaker. On one side of it is a button marked "Salt", and on the other one marked "Pepper". Press buttons according to taste and shake.

The new French meat can described in "Food Manufacture" last month. Opened by a key, this can is suitable for large meat packs that are sliced and sold retail.

Holidays with Pay for Canning Employees

A. W. Foster and Co., Ltd., the fruit and vegetable canners, have just announced "Holidays With Pay" and "Group Life Insurance" schemes to their 200 employees. The holiday scheme is worked on a sliding scale, the length of the holiday for which pay is allowed depending upon the length of service and the position of the employee.

All employees after one year's continuous service come under the Life Insurance Scheme, the entire cost of which is borne by the company. Workers are insured for about £100 at the commencement; this rises to about £400 after 15 years' service.

Forthcoming Events

May 19.—Society of Chemical Industry (Food Group) Annual General Meeting. London School of Hygiene and Tropical Medicine, 8 p.m.

May 25.—Coke Oven Managers Association, at Durham. "Factory Painting," by J. R. S. Rhodes.

June 2-12.—Empire Exhibition, Waverley Market, Edinburgh. Promoted by the Overseas League.

June 25-26.—Society of Chemical Industry Summer Meeting. (See details below.)

Mr. John Cadbury Married

The wedding of Mr. John Cadbury and Miss Lucy Agatha Tangye took place at the Friends' Meeting House, Stourbridge, on April 8. Mr. John Cadbury is Managing Director of Cadbury Bros., Ltd., and Miss Tangye's family are well known for their connection with the Birmingham firm, makers of hydraulic machinery and oil engines. A piece of cake was given to each of the 9,000 employees of Cadbury Bros., Ltd., to commemorate the event.

What is Vinegar?

Sir Rollo Graham-Campbell, delivering a considered judgment at Bow Street Police Court recently, decided that vinegar was the product of fermentation and that diluted acetic acid, not produced by fermentation, could not be sold as vinegar.

A fried fish shop proprietor was fined £5 and ordered to pay 25 guineas costs for selling artificial vinegar as table vinegar.

Sir Rollo Graham-Campbell said the question he had to determine was whether it was permissible to sell as vinegar a substance which was not malt vinegar and which was non-brewed. Since the early part of the seventeenth century the commodity ordinarily sold in this country as vinegar was the product of fermentation, and it was not until 1890 that the fluid in question made its appearance on the market, although possibly there might have been isolated cases in which it was sold as vinegar as far back as 1860. Both vinegar, which was the product of fermentation, and the substance sold in this case were composed of acetic acid diluted with water in much the same proportions, but the acetic acid in the one was produced in a way different from that in the other. The vinegar produced by fermentation gave the finished article a better aroma and flavour and also contained other products of fermentation not present in the other compound.

Germany to Reduce Food Imports

General Goering has announced important measures under the German Four Year Plan to make Germany independent of foreign food supplies. During 1937 £18,000,000 is to be spent on drainage and soil improvement; fertiliser prices are to be substantially reduced and a 30 per cent. increase in Germany's food production is hoped for.

Lemonone A for Flavouring

Lemon oil users will be interested in the announcement just made by the Glyco Products Co., Inc., New York City, on Lemonone A.

This product successfully replaces lemon oil completely in many cases, and in part for cosmetics, sweets, cakes, beverages, ice-creams, etc.

Because of its extremely low price, it can be mixed with lemon oil and thus reduce the cost of the flavouring or odour material considerably.

Contest for Arc Welders

Some interesting literature has come to hand concerning the James F. Lincoln Arc Welding Foundation. This is a contest, promoted in honour of Mr. J. F. Lincoln, President of the Lincoln Electric Company, U.S.A., and director of the Lincoln Electric Co., Ltd., Welwyn Garden City, Herts. The prizes to be awarded in the various sections of the contest total $200,000.

To quote from the official announcement, the purpose of the Foundation is "to encourage and stimulate scientific interest in, and scientific study, research, and education in respect of, the development of the arc welding industry through advance in the knowledge of design and practical application of the arc welding process, and to provide for the payment of the awards, by prizes, to those persons who by reason of the excellence of their papers upon said subject may be selected in the manner herein provided as most worthy to receive such awards."

There are section and sub-section prizes, and the scope of the contest covers every industry. Section K is devoted to industrial machinery; sub-sections are K1, Processing, and K7, Food-making. Papers are required on the design, modification, or upkeep of such plant from the arc-welding point of view. Further details from the Secretary, The James F. Lincoln Arc Welding Foundation, P.O. Box 5728, Cleveland, Ohio.

Useful Asparagus Knife

We have received from Hermann Stein and Co., G.M.b.H., of Magdeburg, a sample of the new asparagus knife which they have recently put on the market. This instrument is said to be both labour-saving and economical, and is already widely used in the canning industry in Germany. It has also a distinct advantage in weight over any instrument hitherto used for this purpose, being nearly 10 per cent. lighter than other knives. It will be seen from the illustration that the construction of the "Spargetmetz" prevents wasteful peeling. In an accompanying note the makers suggest that manufacturers should try out the knife on those among their workers who are beginners, as new methods, however good, are not always easily accepted by older hands.

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Mexico is looking forward to a good vanilla crop this year, and an increase on last season's production is expected. Most of the present crop has already been sold in the U.S.A. market.

Compressed Grain

Two Englishmen are said to have discovered a secret process for compressing grain. If it is proved to be successful, it may revolutionise supplies of vital foodstuffs in war-time.

The inventors are Mr. A. R. MacCabe and Mr. R. P. Smith, of Bournemouth.

The new method of compressing grain into waterproof, non-inflammable, gas-proof blocks reduces bulk by a third.

In the past the difficulty of carrying wheat by plane, apart from the bulk, has been the risk of explosion caused by powder and dust.

Shipping and insurance companies have long sought a safety process such as the two Englishmen have discovered.

The inventors claim that by their process the grain is sterilised.

Hull Firm Expands

J. H. Fenner and Co., Ltd., power transmission engineers, are again extending their factory premises at Hull. The new buildings will embody many modern features, including atmospheric control, and will be used mainly for the manufacture of rubberised solid woven beltings and "Z" Dressed products.

New Factory in Netherlands Indies

We understand that a new palm-oil factory costing £110,000 is to be erected in the Netherlands Indies by the Amsterdam Rubber Company. The factory will have an output of more than 20,000 tons per annum, and will be constructed by Stork Bros. and Co.

A new knife for asparagus canning operatives, from Germany. See paragraph to the left of this illustration.

TRADE ADVERTISING

Publicity for Cream?

The present Milk Act expires in August; in the Bill which will follow it, the Milk Marketing Board will seek to create three standards by which all cream will have to be sold. Scottish and Irish interests are taking part in the discussions, and it is understood that if these standards can be formulated in time for inclusion in the new Bill, an extensive publicity campaign for cream will be launched.

New Lemon Barley Powder

George Borwick and Sons, Ltd., will advertise this new product in the national Press, and by radio from Luxembourg, Normandy, and Lyons.

Biscuits and Bread

Frears, Ltd., and Frears and Black, Ltd., of Leicester, are two newcomers to advertising. Both companies have a registered capital of over £70,000, and advertising schemes are now under consideration.

Press and Radio

National newspapers and Radio Lyons are included in the 1937 campaign of Goodall Backhouse and Co., Ltd., for their new 6d. pack of Yorkshire Relish.

Vitamin Custard

This is a new line from A. Bird and Sons, Ltd., and is advertised to the public in the national Press.

Orangeade from U.S.A.

"Green Spot" Orangeade, already well known on the other side of the Atlantic, is to spend £35,000 on advertising and publicity in this country. Media will be aerial advertising and medical and local Press.

Metro-Vick Calendar

A charming calendar from the Metropolitan-Vickers Electrical Co., Ltd. Illustration continues this firm's "Girl" series, and is a beautiful piece of work. Period of calendar is April, 1937, to March, 1938, and not, as is usual, from one January to the next. Thus do Metro-Vick keep aloof from the annual Christmas to New Year flood of calendars, desk pads, and diaries, and secure extra attention thereby. The idea seems to merit consideration from many other firms.

Coronation Programmes

We are informed by King George's Jubilee Trust that many firms are ordering quantities of Coronation Programmes for presentation to their employees as mementoes. In some cases the volumes are supplied with specially printed presentation bands, and among those firms that have already placed orders are some of the most widely known concerns in the country. The Official Programme is a work that has been produced with much thought and care; it is available in the standard edition at 1s. or the special edition at 2s. 6d. Enquiries should be sent to King George's Jubilee Trust, St. James's Palace, London, S.W.

Duplex Mixing Machines

In last month's issue we referred to these machines, made by E. Hunt and Co., Ltd. Any trade enquiries should be sent to the agents, Lavino (London), Ltd., 48, Fenchurch Street, E.C. 3.

Imports of Canadian Pectin

Mr. H. G. Williams asked the President of the Board of Trade in the Commons recently whether he has now considered the effect on the production in this country of the dumping of Canadian pectin at prices far below the prices at which pectin is sold in the Dominion of Canada; and what steps he proposes to take in this matter.—Mr. Runciman: The question referred to by my hon. friend is receiving consideration, but I am not yet in a position to make any statement on the matter.

Container with a Reason

Duff's molasses, product of P. Duff and Sons, Pittsburgh, U.S.A., was for over 40 years offered for sale in the original tin can with old-fashioned paper label. The introduction into the company of an aggressive policy resulted in an investigation of consumers' likes and dislikes. The housewife expressed herself freely, but none too pleasantly. She liked molasses, but she did not like paper labels, nor did she like to punch holes in the can from which to pour the molasses. She complained most that the molasses ran down the sides of the can and made her shelves sticky, as well as the paper label. Duff's therefore designed a new molasses container on the lines of the now familiar beer can. A lithographed design replaced the paper label. A further improvement was made when a screw cap replaced the crown cork, giving an effective re-seal.

TRADE LITERATURE RECEIVED

World Power Conference

We have received a brochure from Percy Lund, Humphries and Co., Ltd., of 12, Bedford Square, London, W.C. 1, announcing publication of "The Transactions of the Chemical Engineering Congress of the World Power Conference." This publication is issued as a complete work, and most of the papers are fully illustrated. There are four volumes and a separate index volume; the papers cover every conceivable angle of chemical engineering, and the price is £12.

Preventing Wood Rot

At the coming Leipzig Spring Fair, a fluid will be shown for impregnating and painting wood, which is odourless, almost stainless, but is claimed to kill all destructive insects as well as any traces of dry rot and other kinds of rotting in the wood. This paint may be brushed on to beams already in place or the wood may be impregnated before use. It is suitable as a means of protecting wood for building purposes, etc. When using this fluid the wood will show a slightly yellowish tint, but the colour is said not to spread to the brickwork or plastering, nor will there be any sweating out of chemicals.

Heat Treatment Journal

Current issue of this useful publication comes from Wild-Barfield Electric Furnaces, Ltd. Articles of interest to all metallurgists. Binding cases now available.

Hygienic Lockers

A well-illustrated catalogue of steel lockers and cycle parks, pictures of some large installations. "Hygienic storage of clothing makes for a fitter Britain."

Renold Power Transmission Accessories

A catalogue has been issued by the Renold and Coventry Chain Co., Ltd., which combines the separate leaflets previously issued, and contains full dimensional information for the following Renold Power Transmission accessories: chain couplings, Renold-Hardy couplings, chain clutches, push-pull remote control, counterweight and rack sets, chain speed transformers, and chain-cases. It has been specially compiled for designers and draughtsmen and gives very full technical data and dimensional drawings; also, simple charts and rating tables are provided to facilitate use and expedite selection of the most suitable product for any application.

Washable Flat Oil Wall Finish

Zolapso is a washable flat oil wall finish made by Arthur Holden and Sons, Ltd., Birmingham. It is said to be unaffected by steam and moisture and can be scrubbed and washed. The finish is non-poisonous and permits full advantage to be taken of the factory acts, as it is claimed that a coating of Zolapso every seven years can be substituted for the usual annual lime washing, two coats on bare walls being sufficient. The product is supplied in 24 colours from which an infinite variety of shades and designs can be made up in shaded, stippled, rag-rolled, plastic effects, etc. From test panels which we have seen, Zolapso has a clear hygienic appearance so necessary for factory decoration under modern manufacturing conditions. The product is described in a series of leaflets issued by the company, further leaflets describing Durus protective paints and Zolapso plastic paint.

New Equipment

This is the title of a new catalogue issued by Constructors, Ltd., drawing attention to the desirability of all works and factories being well equipped at this time. The company offers a range of equipment which includes steel storage and works appliances, steel cycle parks, steel lockers for offices, etc. The company's credit terms cover the whole range of their equipment.

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Copies of recent "Permac" literature dealing with "Permac" metal-to-metal jointing have been received from Thomas and Bishop, Ltd., 37, Tabernacle Street, London, E.C. 2. Illustrations are given of all types of joints—steam, water, gas, oil-flange, screw and tank. "Flexo" belt dressing is another product of this company, which increases the life of belts, enabling them to give increased output.

Magazine from Denmark

"Sabroe News" from Thomas Ths. Sabroe and Co., Ltd., announces retirement of C. Gottlieb, managing director, appointment of Axel Gruhn. Information of interest to refrigeration engineers. Illustrated articles.

Floor Protection

Watco, Ltd., of 236-237, Blackfriars Road, London, S.E. 1, have recently introduced a preparation which is stated to have a sealing effect on the pores in the surface of the wood of factory floors which solidifies and increases the resistance of the wood to all forms of mechanical wear. In the case of concrete it acts as a mechanical binder, and it is claimed that a floor once treated is rendered permanently free from dusting.

A.C. Motors

A.C. Motors up to 60 H.P. is the title of a new catalogue issued by Howells (Electric Motors), Ltd., York Street, Hanley, Stoke-on-Trent, dealing with their range of alternating current electrical machinery, which includes squirrel cage, slip ring, and repulsion induction motors, flanged motors, lift motors, interchangeable motors, motorised syrens, buffers, and grinders, and ventilating fans and exhaust fan motors. A leaflet deals with the new "Sovereign" squirrel cage, three-phase motor.

Refrigeration in Breweries

This booklet, issued by J. and E. Hall, Ltd., Dartford Ironworks, Kent, demonstrates the high esteem in which refrigerating plant of their manufacture, particularly the vertical enclosed high speed ammonia compressors, are held in the brewing industry. The booklet contains over 90 pages and practically every page shows pictures of a refrigeration installation carried out by the company.

Economic Boilers

A new catalogue issued by H. and T. Danks (Netherton), Ltd., Netherton, Dudley, deals with Super-Economic Boilers which can be adopted for stoker (automatic or semi-automatic), hand, or oil firing, for power or heating purposes. The catalogue contains 35 pages and is profusely illustrated with these types of boilers installed in factories in different industries. The boilers are said to have met with a remarkable measure of success and have been approved by various insurance companies and consulting engineers.

Monel Metal

From Henry Wiggin and Co., Ltd., "Monel Notes — 2." Interesting magazine, well illustrated articles. "Properties of Monel." Being used for beet and pineapple canning, tomato juice, and dough machines.

Boilers and Tanks

Folder in colours from Stockton Chemical Engineers and Riley Boilers, Ltd., shows some recent construction jobs. Degreasing, bone and offal treatment plant, stills, boilers, jacketed pans, stainless equipment, tanks.

New Laboratory Mixer

From America—Laboratory Equipment Co., New York—a leaflet describing new propeller and shaft mixer for laboratory jobs. Will tackle viscous liquids; speeds up to 2,500 r.p.m. Adjustable, eight angles. Also a Clarity Tester, for visual estimation of solid matter contained in suspension in liquids. Light illuminates bottles containing sample, solid matter readily seen. Useful for sugar solutions, molasses, syrups, jellies, fruit juices, vinegar, etc.

Laboratory Glassware

Well-produced spiral-bound catalogue of scientific and laboratory glassware; some very useful and carefully designed apparatus. From Quickfit and Quartz, Ltd.

Thermostats and Hot Plates

Griffin and Tatlock, Ltd., continue their series of leaflets. Description of hot-wire thermostat and relay, first designed for use in their laboratories, now available to the trade. A useful electric hot plate is a new attachment for a retort stand. Also a drying oven and incubator (thermostatic control) and melting-point tubes.

Laboratory Alarm Clock

A card from A. Gallenkamp and Co., Ltd., describing a short-time meter for the laboratory. Alarm sounds at end of pre-indicated time—up to 1 hour.

Aluminium

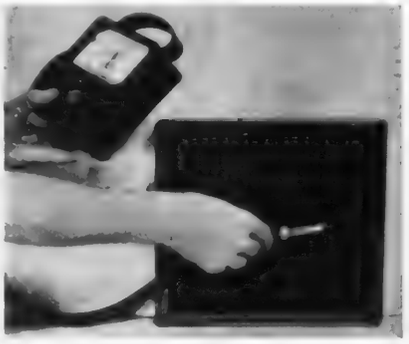
From the British Aluminium Co., Ltd., a book describing their Ideal Home Exhibition Stand. Exhibit showed aluminium in various stages of manufacture and in many finishes, also uses to which it could be put. Models of industrial food plant; tanks, tipping boilers, heating coils; also gelatine pan, essence bottles, and refrigerator ice trays.

*p*H Recorders

Folder No. 56 from the Cambridge Instrument Co., Ltd., concerns *p*H recorders, description and applications. Folder includes reproduction of portion of actual chart taken from installation of Bournemouth Gas and Water Co.

Air Velocity Meter

Interesting literature on Alnor Velometer from Air Conditioning and Engineering, Ltd. Instrument is extremely portable and adaptable under all conditions. Measures air velocity in feet per minute, 20 f.p.m. to 8,000 f.p.m., also pressure of air in inches of water. Special filters available for dust-laden atmospheres. An invaluable instrument for really scientific control of factory atmosphere.



An air-velocity reading being obtained at a ventilation grille with the Alnor Velometer. Portability is one of the most attractive features of this instrument.

Hydraulic Stackers

A leaflet from J. Collis and Sons, Ltd., giving some graphic pictures illustrating the power of their hydraulic stackers and trucks. Leaflet explains economy of hydraulic power.

Insulation

Some very well produced and readable literature on the subject of insulation from Newalls Insulation Company. One booklet deals with ice-cream shippers, cabinets, and refrigeration installations. Another with the subject of heat insulation, particularly of pipe lines and fittings. Some useful tables and diagrams.

Chain Drives

New catalogue MS 237 from the Morse Chain Co., Ltd. Besides being a mere price list, contains much useful data and information concerning the fitting, use, and maintenance of chain drives.

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The B. A. Holland Engineering Co., Ltd., 18, Victoria Street, London, S.W. 1, have sent us a copy of their leaflet dealing with low pressure blowers and exhausters. The leaflet gives details of air-cooled rotary blowers and vacuum pumps, air-cooled low pressure blowers, and rotary air compressors and vacuum pumps. It contains a number of illustrations of these machines and of installations.

PECTIN PROBLEMS

A specially contributed review of some problems that present themselves to-day

by A. G. NORMAN, D.Sc., F.I.C.,

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IN THE May, 1936, number of FOOD MANUFACTURE Mr. T. N. Morris reviewed much of the recent work on the structure of the pectin molecule, and in particular those investigations which have centred round the very valuable property of pectin jelly formation when mixed with appropriate amounts of sugar and acid. It cannot be said that during the past year any sensational advances have been made, and accordingly in this article it is proposed briefly to discuss a few of the outstanding problems which remain to be solved.

Structure of Pectin from Different Sources

Perhaps the most important on general grounds is whether the pectin from different sources is structurally similar and has the same constituent units and basal molecule. In other words, whether there is one substance pectin, or many pectins constructed after the same general pattern, but varying somewhat in the proportions of building units present. Opinion on this point is more or less evenly divided, and it is difficult to arrive at an impartial decision. The properties of large complex molecules of the type of pectin are not sharply defined. The pectin molecule is undoubtedly more fragile than it used to be thought to be, and some groups may be split off by quite mild treatments which do not result in a general breakdown.

The major constituent of the molecule is a polygalacturonide which may easily be determined with precision. The conditions of extraction that are selected not only affect the amount of pectin removed, but also its composition, so that preparations of varying galacturonide content are obtained according to the procedure adopted. In any comparison of the properties of pectins from different sources, or at various stages of maturity of the fruit, a standard method of extraction must be employed. Because so many different procedures have been used it is difficult to make comparison of the results of separate investigators. A further and tiresome difficulty arises in that the pectin obtained by different methods varies in degree of purity as well as in composition, and there is no agreement as to the purification processes that are desirable or to the criteria of purity that may be adopted.

The carboxyl groups of pectin, as usually extracted, are more or less completely methylated. Removal of the methoxyl groups by treatment with dilute alkali leaves the acid free for salt formation. The calcium salt is insoluble and is ordinarily used for the determination of pectin or as an index of the purity of pectin preparations. A variable galacturonide content, however, involves a variable calcium content, so that the latter does not necessarily give a constant equivalent weight. It therefore appears that within limits calcium pectates of slightly different calcium contents may be found. The crucial point is whether the variation in galacturonide content causing this is natural or whether it is a result of the method of extraction employed. By solution and reprecipitation the calcium content of a crude pectin preparation is usually caused to fall to a more or less constant figure after four or five repetitions. For example, Gaddum [*Florida Ag. Expt. Sta. Bull.* 268, 1934] analysed preparations extracted by water and by dilute acid from a number of citrus fruits and found about 7·5 per cent. Ca after purification by this means. His results, as far as they go, might be taken as supporting the theory of the homogeneity of pectin from different sources, at least as far as citrus fruits are concerned.

Against this and similar conclusions must be set the researches of F. Ehrlich which have extended over the past twenty years. In his view the nucleus of the pectin molecule is a tetragalacturonide to which other units are attached. The nature and amounts of these subsidiary units are believed to vary considerably according to the source. For example, galactose and arabinose have been found in orange and beet pectins. Flax pectin has been stated to contain xylose in addition, and ramie pectin a methyl pentose, possibly rhodeose. Fractions of different composition have been obtained according to the temperature of extraction employed. Ehrlich's view appears to be that the pectins are a group of substances similar in structure but different in detail, tetragalacturonide acid being common to all.

Many workers hold that the method of isolation employed by Ehrlich is such that some degradation of the molecule is inevitable. The jellying property of pectin has recently been taken as a criterion of the integrity of preparation, on the grounds that if this power is unimpaired it is unlikely that any extensive changes in the molecule have occurred. Very few pectin preparations used for constitutional work have been tested for jellying power, and it is probably true that in some this property must have been almost completely lost. The viscosity of the solution is another physical property which might with advantage be employed. To arrive at a decision on this important question of the homogeneity or heterogeneity of pectin from different sources, a large number

of preparations must be obtained by mild and identical means, must be purified by a standard procedure and then characterised by physical properties, and analysed for constituent units.

Structure of Pectin Molecule

Another problem which has to be faced is the structure of the pectin molecule. Methylation studies, which have been so valuable and successful in the elucidation of the configuration of sugars and the structure of polysaccharides containing one sugar unit, have not so far been helpfully applied to complex polyuronides of the type of pectin, the hemicelluloses, or the gums, since the separation of the methylated products presents grave difficulties. There is no lack of agreement that the dominant grouping in pectin is a polygalacturonide. According to Ehrlich, this is tetragalacturonide, normally in a closed ring, but which may under certain circumstances be opened to give a lactone with reducing properties equivalent to one aldehyde group per tetragalacturonide unit.

This conclusion has been rendered doubtful by the researches of Link (Morell, Baur and Link, *J. Biol. Chem.*, 1934, **105**, 1), who has methylated a pure polygalacturonide obtained from pectin by very mild alkaline treatment, and found the insoluble residue to be a methylated polygalacturonide consisting of 8 to 10 galacturonic units in the form of a chain. The carboxyl groups are esterified by methyl alcohol, just as they are believed to be esterified in pectin. Treatment with dilute alkali, however, removes these methyl ester groups, leaving intact the glucosidic methoxyl group attached to the reducing end of the polygalacturonide chain. The amount of this terminal methoxyl present serves as a measure of chain-length. The implication of this work is that the structural unit of pectin must contain a polygalacturonide with a minimum size of 8 to 10 units, and since degradation is very likely to occur in the prolonged treatment with methyl alcohol and hydrochloric acid, the actual chain-length is probably much greater.

Attachment of Other Constituent Groups

Of the method of attachment of the other constituent groups, generally agreed to be galactose and arabinose, nothing is known. The linkage is neither strong nor stable, for quite brief treatments with dilute acid or alkali result in more or less extensive removal of these sugars. The susceptibility of pectin to hot dilute acid or alkali is most marked and unusual among polysaccharides, indicating again the peculiar structure of the pectin molecule.

Variation of Jellying Power

From a practical viewpoint there is a most important group of problems connected with the formation of pectin jellies. Apart from the fundamental question as to why pectin with appropriate amounts of acid and sugar gives a jelly at all, there remains to be explained the great variation which is observed in the jellying power of pectin from different fruits. Many of the factors concerned in jelly formation, such as the optimum concentration of sugar and acid, the effect of the presence of salts, etc., have been extensively investigated, and although these cannot all be said to be fully understood there is sufficient knowledge for many purposes. It is in the quality of the pectin itself that least is known.

A number of theories exist, but all are found on examination to be insufficient to account for observed differences. Jellying is a physical phenomenon and related to the physical condition of the pectin molecule. It is more and more becoming realised that the properties of polysaccharide and other molecules of great size are determined to a considerable extent by the state of molecular aggregation in which they occur, and that two preparations, apparently identical chemically, may nevertheless behave quite differently because of a change in molecular architecture. One may give as examples native and coagulated proteins, or cotton cellulose, and the purified α-cellulose from wood. Though chemically similar, the physical properties of each are very different. It may therefore be expected that something of the same sort might be met with in pectin, but so far this has not been proved, though strongly suspected.

Many investigators have preferred to think that chemical differences might account for the varying qualities of pectin in forming jellies, and up to a point this is no doubt true. Certain treatments are known to impair or destroy jellying power, and if the effect of these treatments is to split off some grouping of the molecule it is dangerously easy to assume that the jellying power is controlled by the proportions of that particular grouping present, whereas in fact other changes, less obvious, may have been simultaneously effected in the molecules.

This is probably true of the methoxyl content of pectin which many workers have supposed to influence jellying power. It has frequently been shown that treatments which result in demethylation also reduce the jellying properties, and that completely demethylated pectin—namely, pectic acid—fails entirely to give a jelly. Nevertheless, considerable change in the jellying power of pectin preparations has been effected without appreciably altering the methoxyl content [Myers and Baker, *Del. Ag. Expt. Sta. Bull.* 187, 1934], and the preparations of the highest jellying power have not always been found to be those of the highest methoxyl content.

It is therefore probable that the methoxyl content is not a measure of jellying power, though the reduction in methoxyl content brought about by any given treatment may be paralleled by a loss in jellying activity. The percentage of galactose and arabinose in the molecule may similarly be somewhat lowered without reducing the ability to form jellies. In fact, there seems to be no single group in the pectin molecule, the amount of which may be said to control jellying power. The suggestion has, however, been made that this is dependent on the degree of polymerisation of the galacturonide. If the long-chain structure is found to be correct, then presumably the length of this chain will prove to be the vital factor. Depolymerisation or, perhaps more accurately, fracture of the chain into shorter lengths, can presumably be effected by quite mild treatments. This is in accordance with experience with cellulose, the molecules of which are known to be long chains of glucose units.

That the chain-length or degree of polymerisation of the galacturonide is probably the dominant factor is supported by viscosity measurements of pectin solutions. Viscosity is another physical property which is dependent on molecular size, or form of molecular aggregation, and it is therefore of significance that up to a point there is good correlation between the viscosity and jellying power of pectin preparations.

If it is established that chain-length of the galacturonide portion of the pectin molecule primarily controls jellying power, then an explanation is provided for the observed variation in jellying quality of pectin from different fruits, and methods used in extraction must be chosen with a view to the maintenance of molecular size. In practice, it may be necessary to hold the balance between yield and jelly quality, since those conditions producing pectin of the highest jellying power may not be those giving the greatest yield.

Enzymic Degradation

The enzymic degradation of pectin provides problems still to be solved. To some extent their solution is dependent on further knowledge of the structure of the pectin molecule. Two enzymes are commonly recognised—pectase (or pectin-methoxylase), an esterase which accomplishes the de-esterification of pectin, and pectinase (or pectolase), which breaks down the polygalacturonide and splits off the sugar units. The latter enzyme, as usually obtained, always contains the former, and because of the complex nature of the system, the changes are difficult to measure. Takadiastase preparations invariably seem to contain pectin enzymes and bring about a rapid degradation of pectin as measured by the reduction of viscosity. Such preparations have been employed for the removal of starch from apple pectin extracts prior to the preparation of jellies, and must have the effect of reducing the quality of the pectin in jelly formation.

All these problems are being actively studied in various laboratories, so that it is probably only a matter of time before the solution of them will be found. The results should be of considerable fundamental importance as well as of great practical value. The chemistry of pectin is fascinating in its difficulties. Knowledge of its structure may help to illuminate some dark places in the physiology and metabolism of the cell-wall substances of plants, as well as to provide the explanation for the valuable and unique property of jelly formation. Once it is known, improvements in control will follow on a sound basis instead of as a result of empirical tests.

DETERMINATION of SUGAR PRODUCTS

ABSTRACTS of three of the papers read before the Sugar Division of the American Chemical Society at Chapel Hill, N.C., April 12 to 15, 1937.

A Comparison of Chemical and Mechanical Methods for the Determination of Starch in Sweet Potatoes and other Plant Products. F. H. Thurber, U.S. Department of Agriculture, Bureau of Chemistry and Soils.

This paper deals with the variations in percentages of starch obtained by different analytical methods and by mechanical extraction of starch. It has reference primarily to analysis of sweet potatoes and extraction of starch therefrom in connection with sweet potato starch manufacture.

Determination of Moisture in Corn Syrup and Corn Sugar. W. R. Fetzer and J. W. Evans, Union Starch and Refining Co.

The above authors several years ago presented an extended table on Baumé-Moisture-Dextrose Equivalent relationship. The data gave higher moisture values than those previously accepted. For this reason the results have been questioned on the basis of dextrose decomposition. The above authors have originated a method of vacuum drying on filter paper by a novel method, whereby they spread the corn syrup over definite surface areas, establishing a maximum area for a given quantity of syrup, which results in a maximum amount of moisture. Increasing the surface area over this amount fails to register any increase in moisture content. The data obtained check the previous published data by toluene distillation.

Analysis of Mixtures containing Dextrose, Levulose, Maltose and Lactose. F. W. Zerban and Louis Sattler, New York Sugar Trade Laboratory.

Previous studies on the determination of dextrose and levulose have been extended to mixtures containing also maltose and lactose. In the proposed method the total reducing sugars are determined by means of Soxhlet's solution, the monosaccharides with Steinhoff's modification of Barfoed's solution, and levulose by the method of Jackson and Mathews. Lactose is found by oxidation to mucic acid, or by copper reduction after fermenting off the other sugars. Four equations are thus obtained, from which the percentage of each sugar can be calculated. It has been found that both maltose and lactose have a slight reducing effect on Steinhoff's reagent as well as on Jackson and Mathews' reagent. The effect is appreciable enough to require a correction.

PRESERVATION OF FRUIT JUICES

THE latest development of Matzka's sterilisation apparatus for the preservation of fruit juices, wine, milk, etc., was explained at a meeting of chemists at Winchester House, London, last month. It is hoped to form a company to handle British patents applying to the whole of the British Empire except Canada. Mr. De Lange, a Dutchman, who is controlling the formation of the British company, presided, and Mr. Matzka, the inventor of the process, told of his work in perfecting the latest apparatus. It is claimed that fruit juices preserved in accordance with this method retain their natural physiological composition and can be stored for any length of time. Milk preserved this way, it was stated, keeps its full vitamin content and does not turn sour.

Recent Advances in the

STERILISATION OF MILK

By Ralph G. Harry, A.I.C.

A brief account is given of the effects of Pressure, High and Low Frequency Currents, Cathode, Röntgen and Sound Waves on bacteria. Some of these have been successfully applied already to the sterilisation of milk, in particular the electrical and pressure effects, whilst sound effects may offer development in the future.

It is difficult to forecast the methods by which future generations may safeguard the national milk supplies, but it is improbable that ultra-violet light can be adopted to such a use. Electrical effects may supersede all others, but this is purely conjectural. In the meantime, until more information is available, the only safe method is that commonly employed—namely, heat.

Heat is the agent universally employed at present for sterilising milk, although the ideal agent would be one causing simple mechanical injury to the bacterial flora without affecting in any way the nutritive value of the milk. Of recent date interest has been aroused in the possible commercial application of other physical methods of attaining this end, and this article details some of the more important of these.

The Effect of Pressure

As already stated, the ideal sterilising agent would be one causing purely mechanical injury to the bacterial life, but so far this has not proved successful.

Hite (*Bull.* 58, *W. Va. Agr. Exp. Sta.*, 1899) reported that after subjecting milk to a pressure of 90 tons per sq. in., it kept without souring for two weeks, but on further storage it deteriorated, owing to enzyme action.

Macheboeuf, Basset and Levy (*Ann. Physiol. Physiochem. Biol.*, **9**, 713, 1933) more recently have shown that enzymes are more resistant to pressure than vegetative bacterial cells, although their resistance is less than that of bacterial spores.

Pressure in the presence of carbon dioxide has been shown to be more effective than pressure alone, and Swearingen and Lewis (*J. Bact.*, **26**, 201, 1933) found that carbon dioxide, under a pressure of 300 lb. to the square inch, killed the majority of a culture of *Eschericha coli*.

Attempts to increase the lethal effect of pressure, by suddenly releasing it, showed no increased effect, neither, within certain limits, did alteration of the *p*H of the medium, the controlling factor being the "duration of the pressure".

Recent experiments by Hofius, in which milk was maintained in a container in contact with oxygen under a pressure of 10 atmospheres, at a temperature of 4° to 8° C., have shown that by this means milk may be maintained in good condition for at least seven weeks, and interest has accordingly been revived in pressure processes which in future may prove of great economic importance.

Electrical Effects

The Use of Low-frequency Currents.—Zeit (*J. Amer. Med. Assoc.*, **37**, 1432, 1901) showed that direct current was able to produce effects upon cultures of parasitic bacteria, partly on account of the heat produced by the passage of the current, but more particularly by the chemical action of the products of electrolysis.

In 1919, Anderson and Finkelstein (*J. Dairy Sci.*, **2**, 374, 1919) investigated a process for the purification of milk, and obtained results which compared favourably with those attained by pasteurisation, and, moreover, the cream line was not destroyed. They concluded that the bacteria were readily killed by heat.

However, Beattie and Lewis (*J. Hyg.*, **24**, 123, 1925) showed that although the heat effect could not be ignored, yet since *B. coli* and *B. tuberculosis* were killed in a few seconds at a temperature not exceeding 64° C., in the apparatus they employed, the current itself, in addition to any heat generated, must have acted as a germicide.

More recent investigators have confined themselves to the efficacy of the method of sterilisation rather than the problem of the electric effect, and Devereux, 1929 (*Quart. Bull.* 12, *Mich. Agr. Exp. Sta.*, 20) claimed a 99 per cent. efficiency for the destruction of bacteria. Experiments show that the temperature attained inside the spores is higher than that of the surrounding medium, and there is thus a temperature stress set up.

It is interesting to note that in several parts of the United States permission is given for the use of the electrical method for sterilisation of milk supplies.

Cathode Rays.—Wyckoff and Rivers, 1930 (*J. Exp. Med.*, **51**, 921) bombarded *B. coli*, *B. typhi-murium*, and *Staph. aureus* on the surface of agar plates with known numbers of cathode rays and estimated the proportion of surviving organisms from colony counts after incubation of these plates: 83·1 to 93·9 of the organisms were killed after 20 seconds, and quantitative analysis showed that the absorption of a single electron was usually sufficient to produce death. It appears that the action of such cathode rays depends upon the release of a large number of ions consequent upon the absorption of an electron, and the effect of this "ionic shower" on such small organisms is fatal, although with yeast cells injury without death may result (Wyckoff and Luyet, *Radiology*, 1931, **17**, 1171).

Röntgen Rays.—Wyckoff exposed *B. coli* and *B. typhi-*

murium on agar plate surfaces to soft X-rays, destruction being produced, but less rapidly than with cathode rays. After 20 seconds' exposure to a filtered copper radiation, only 19·6 to 33·3 per cent. of the organisms were killed, and analysis showed that only about one in twenty of the absorbed quanta of such radiations proved lethal. The harder X-rays, however, appear to approach more closely in germicidal power to the cathode rays, and Pugsley, Oddie and Eddy (*Proc. Roy. Soc.* (B), 1935, **118**, 276), working with *B. coli* with apparatus in which a correction factor was introduced for the lack of uniformity of the X-ray beam, showed that these organisms died in the usual exponential manner.

Sound Waves.—Sonic waves (*i.e.*, waves of audible frequency of about 8,900 cycles per second, have been claimed to exert a germicidal effect, and Chambers and Gaines (*The Milk Dealer*, 1932, **21**, 7, 40) have reported a method for destroying 80 to 100 per cent. of the bacteria in raw milk by passing it through a nickel tube vibrator having a vibration frequency of 8,900. By means of continuous flow, the outflow being repassed, a large proportion of the spores of even the *B. subtilus* were destroyed in 15 minutes, and it is not unreasonable to believe that future improvements in design might lead to its commercial adoption in the sterilisation of milk supplies. Such germicidal effects are in accordance with experiments conducted by Wood and Loomis (*Phil. Mag.*, **4**, 417, 1927), who found that the exposure of paramecia, erythrocytes and cells of Elodea to sound waves having a frequency of 300,000 cycles caused their rupture.

Supersonic waves, waves above audible frequency (from about 200,000 to 1,500,000 cycles per second) produced by connecting a piezo-electric crystal with a high-frequency oscillator, have also been found to possess germicidal power, although insufficient work has been carried out as yet to justify any actual claims. Observations by Beckwith and Olson (*Proc. Soc. Exp. Biol.*, N.Y., **29**, 362), Yen and Liu (*Proc. Soc. Exp. Biol.*, N.Y., 1934, **31**, 1250), and Takahashi and Christensen (*Science*, 1934, **79**, 415) appear to show that considerable destruction not only of bacteria but also of filtrable viruses may be brought about by exposure to such vibrations. It is probable that the action of the waves, which are molecular and not electro-magnetic, is due to the disruption of the cell consequent on the agitation produced by its contents.

Liu and Yen claim that no effect is produced if the cells are exposed *in vacuo*, which appears to show that dissolved gases are active agents in such disruptions.

The Action of Light

In 1877 Downes and Blunt showed that exposure of a putrescible liquid to light sterilised it, and quite recently this action has been reinvestigated by Burnet (*Aust. J. Exp. Biol. Med. Sci.*, 1925, **2**, 65), who found that staphylococci would not grow on agar plates exposed to sunlight, although normal growth occurred on control plates stored in darkness. Burnet was able to show that this was due to the inhibitory effect of small quantities of hydrogen peroxide produced by the exposure.

But light itself consists of a mixture of primary colours, and these possess varying powers of inhibiting bacterial growth. In 1892 Ward, by exposing gelatin and agar plates inoculated with anthrax spores to sunlight, was able to show that the inhibition produced was not due to the heat rays nor desiccation, but to the actinic rays of the sun themselves. Further investigations showed that if the spectrum was thrown upon an inoculated agar plate the inhibitory effect was stronger at the blue than at the red end. In 1903 Barnard and Morgan, using a carbon arc spectrum, showed that the bactericidal action of light was due almost entirely to those radiations in the ultra-violet region of wave lengths from 3,287 to 2,265 Ångström units, and this has since been confirmed by other workers.

Ultra-violet light is, in fact, a general protoplasmic poison and destroys not only bacteria and other unicellular organisms, but also the tissue cells of plants and animals.

The effect of ultra-violet light is not due to the ozone produced, nor to the production of hydrogen peroxide, but probably by the induction of some change in the protein molecule. Observation of bacteria so treated has shown that they become granular and exhibit, microscopically, evidence of incipient coagulation. The successful use of ultra-violet light for the sterilisation of water supplies has led to increased discussion as to the possibilities of its use for the sterilisation of milk. This, however, appears to be quite impracticable, if not impossible. Only clear water lends itself to such treatment, as the suspended and dissolved matter in milk not only absorbs rays of such short wave length but also screens the bacterial flora. Even after several minutes' treatment of very thin layers of milk not all the bacteria are killed, whilst a serious objection is the very unpleasant taste produced. Römer and Sames (*T. Hyg. Rundschau.*, 1910, **20**, 873) reported that this undesirable flavour was accompanied by a lowering of the iodine number in cream and butter and a destruction of the oxidase reaction in milk.

APPLE and CARROT JUICES

A NEW factory is planned for Wisbech for the manufacture of apple and carrot juices and fruit vinegar. It is hoped that production will commence in September. This announcement was made recently at a dinner and dance arranged by the Wisbech Chamber of Trade by the chairman of the new company, Mr. C. C. Kline. The company will be known as Orchard Products (Wisbech), Ltd.

Some thousands of tons of apples and carrots will be required, and Dr. H. M. Freund will superintend the making of the juices; he has had much valuable experience in this direction, and developed the process by which "Apella" is manufactured by the Cambridgeshire Fruit Juice Company. This latter company is to be taken over by the new concern.

The production of apple juice will only occupy the apple season of 12 to 20 weeks, and the remainder of the year will be devoted to carrots and, it is hoped, red currants.

BOOK REVIEWS

Chemical Engineering

A second edition of this well-known and very useful book, first published in 1931, is particularly welcome. It is a book which is of value not only to the chemical engineering student but also to the large number of industrial chemists whose work brings them into contact with plant operation in general and with the design of plant in particular. It should prove extremely helpful to the latter class of individual in that the method of treatment adopted does not pre-suppose a knowledge of engineering, and from the fact that the discussion of each section commences with the fundamental principles involved and develops them on practical lines in a simple and systematic manner. The authors rightly offer no apology for the use of the calculus throughout the text, but graphical methods have been emphasised in order to render the use of the calculus as simple and straightforward as possible.

The arrangement of the subject matter is based on the comparatively recent recognition that chemical engineering has for its basis a series of " unit " operations, which operations are by no means confined to the chemical industry proper, but which are of common use in the so-called " process " industries, such as those concerned with the manufacture of food, textiles, soap, gas, and other commodities. It is thus with the general application of these operations that chemical engineering is concerned, rather than with their specialised application to any particular set of conditions. This point of view is maintained throughout the book, which includes chapters on fluid flow and transportation, heat transmission, evaporation, diffusion, humidity and air conditioning, drying, distillation, gas absorption, extraction, crystallisation, filtration, mixing, crushing and grinding, size separation, and conveying. Where possible an attempt is made to distinguish between the different fields of usefulness of different types of equipment for carrying out the same process, and, in some cases, to correlate features of their design with the theory of the operations they are to carry out.

A comparison of the present volume with the first edition shows that all subject matter has been thoroughly revised, and that rather more than one-half has been re-written, not only with a view to bringing the book up to date, but to achieve greater clarity or simplicity in presentation. The principal changes appear in the chapters on heat flow, evaporation, drying, distillation, gas absorption, extraction and filtration. The use of dimensionally consistent units in place of miscellaneous engineering units will be particularly welcome.

A feature of the book is the care devoted to the illustrations, which are line drawings, all of which have been specially prepared for the purpose. As a result of this, unnecessary equipment details are omitted without loss of emphasis of the fact that such equipment must be built of definite parts which must be designed, fabricated and assembled. For this reason these constituent parts have been drawn as accurately as possible. The ten appendices include some very useful physical and engineering data.

H. W. C.

Elements of Chemical Engineering. By W. L. Badger and W. L. McCabe. Pp. xvii+660, with 311 figures. Second Edition. 1936. 30s. net.

Freezing Fruits and Vegetables

The United States of America is the only country in which the preservation of fruits and vegetables by freezing has so far become important; it is therefore natural that the first comprehensive book on this subject should have come from there. The authors have not attempted to give all the details connected with commercial freezing operations; their general claim is that they have stated the broad principles of the selection of raw material of the proper variety and maturity and of its preparation, freezing, storage and handling.

The opening chapters deal with the principles of refrigeration, various types of refrigerating systems and plant, the principles of cold-store construction, insulating materials and the like. A distinction is made between " sharp-freezing " and " quick-freezing ". The former is defined as freezing in an ordinary chamber at from −20° F. to +15° F., and is really " slow-freezing " as compared with that obtained by the various methods and appliances described under the heading " quick-freezing systems ", of which a list of patents is given. The general suggestion is made that " quick-freezing " is superior to " slow-freezing "; obviously, however, consideration of cost and of the purpose for which the material is intended must be weighed against any slight improvements in the colour and texture of certain frozen products which may result from quick-freezing.

The changes which occur during the preparation, freezing, cold-storage and thawing of fruits and vegetables are discussed very fully, although one misses a reference to the work of Chambers and Hale (*Proc. Roy Soc. B.*, vol. 110, 1932), who showed that the death of a plant or animal cell does not occur until ice actually invades the protoplast, even though there may be considerable ice formation outside it with accompanying plasmolysis.

Matters of practical importance, such as the methods of handling, packaging and the idiosyncrasies of different fruits and vegetables and of different varieties of the same species, are dealt with thoroughly; also a whole chapter is devoted to the theory, practice and laboratory control of blanching vegetables prior to freezing.

There are chapters on freezing fruits for the manufacture of ice-cream and the manufacture and preparation of fruit juices. Nothing is said, however, of the possibility of concentrating fruit juices by freezing, and only the American work on fruit juices, cider, etc., is reviewed.

In dealing with the temperature and other conditions of storage, the authors are undoubtedly sound in advocating low temperatures bordering on 0° F. if products of consistently high quality are to be obtained; they also draw attention to the importance of matters like air circulation and the proper spacing of cold-stored material.

The methods of transporting and marketing frozen foods have been fully treated, and there are valuable chapters on the vitamin content and also on the cooking and serving of frozen products (the latter by Lucy E. Kimball).

The book is of a handy size, well illustrated and contains numerous tables of useful data. There is also an extensive bibliography at the end of each chapter and a general subject index, but no general index of authors.

The list of those who have read the proofs indicates that the book has passed the test of inspection by many of the leading American authorities on refrigeration, and, setting aside all minor criticisms, there can be no doubt whatever that the authors have ably met a real need and that their work will be invaluable to all connected with the new industry.

L. T. R. S.

The Freezing Preservation of Fruits, Fruit Juices and Vegetables. By Donald K. Tressler and Clifford F. Evers. Demy 8vo. Pp. 351; 69 illustrations.

Bacteria Control in Bacon Factories

The essential features of bacon curing are accurate control of the micro-organisms that produce the flavour and absolute cleanliness throughout the factory processes. The bacteria are allowed to work freely and produce the desired flavour; when this point has been reached the bacon enters the brine tanks and they are killed. The function of these micro-organisms is not yet fully understood, but the necessity for absolute cleanliness is appreciated. The ideal conditions are laid down in a book just published by the Bacon Development Board. The same book tells us that we do not work or play so hard as our forefathers, and we therefore lose less salt in perspiration; this accounts for the modern tendency towards mild-flavoured bacon.

J. R.

Hygiene in the Bacon Factory. The Bacon Development Board. 1s.

AMERICAN MOULDINGS ON SHOW

An exhibition of American mouldings was given recently at Dorland House, Regent Street, London, W.1, by Synplas, Ltd. The collection comprised moulded fittings and articles for all trades, and well illustrated the wide use to which plastics are being put in the U.S.A. to-day.

It was noticed that there is a tendency to make larger articles in plastic in America than is the case in this country, in one or two instances. There were many examples of plastic caps and closures for bottles and jars.

In some cases it was particularly noticed that the design of the mouldings was very ingenious; there were some clever ideas that should prove very interesting to the English plastic industry. Such smartness of design, however, was frequently spoiled by poor workmanship; it seemed to be a general opinion that many of the pieces on view were far below English manufacturers' standards of quality. Nevertheless, it was generally agreed that the exhibition was very interesting as a whole, and Messrs. Synplas are to be congratulated on their progressive venture.

It would be interesting if a similar exhibition of English mouldings could be arranged in the U.S.A. and commented upon by American moulders. Further exchanges of products in other trades suggest themselves; such an interchange of ideas cannot but benefit the industries on both sides of the Atlantic.

CANNED FOODS and NUTRITION

Second Information Circular from Tin Council

From every field of scientific research upon nutrition, chemical, bacteriological, biological or physiological, there has been in recent years an abundant harvest of knowledge which has shown the necessity for revising many of the firmly established ideas on diet. Enlightened nations are making great efforts to hasten these changes by educative propaganda amongst all sections of the community. Much of the information disseminated for this purpose concerns the nutritive value of the various kinds of foods that are ordinarily available. To-day when the majority of fresh foods can be had already prepared and cooked in cans, it is essential in the public interest to supplement this information with the facts which have so far been ascertained as to the effect of the canning process on nutritive values. A survey of these facts has been prepared in the form of a booklet by H. B. Cronshaw, Ph.D., at one time Editor of Food Manufacture, for the International Tin Research and Development Council, entitled *The Wholesomeness of Canned Foods*. The booklet is issued free by the Council as Information Circular No. 2.

The methods used in canning and the principles of the process are stated shortly, and the extreme suitability of the can for the purpose is explained. The question of the safety of canned foods is thoroughly discussed in regard to the possibility of harmful effects arising from contact of the foods with the metal of the container and from decay or decomposition of them by bacteria. Medical testimony to the harmlessness of canned foods is not lacking, and the evidence as to the extent to which vitamins and other nutritive values are affected by canning and by cooking is considered. It is of interest to note that the British medical authorities have drawn special attention to the advantages to health made possible by the consumption of canned fresh foods in winter time.

Information Circular No. 2. Pp. 20. 9¾″×6″. Illustrated. Issued gratis by the International Tin Research and Development Council, Manfield House, 378, Strand, London, W.C.2.

ELEMENT DEFICIENCY and PLANT DISEASE

Much has been written lately in technical and daily papers regarding the effects of nutritional deficiency on the health of human beings and on the research work being carried out in this connection. Now our attention has been called to parallel research in the vegetable kingdom. The extent to which deficiencies in minor elements are the cause of diseases in plants has been under investigation for some time at many agricultural research institutes and Government experimental stations. Results already obtained indicate strongly that the absence of available boron in the soil is responsible for certain diseases in sugar beet, swedes and turnips, particularly in dry seasons, and it is likely in the near future, if confirmation is obtained, that a small proportion of borax will be included in many fertilisers.

CORRESPONDENCE

Copper in Tomato Purée

Sir,

Your correspondent has dealt very fully with the above subject, and on the surface appears to have made out a very good case for a limit of 25 parts per million as the recognised copper content for tomato purée, but I venture to point out that in the Report of the Chief Medical Officer of Health for 1934, a warning was issued that the regulations concerning the admission of contaminated purée would be enforced more stringently in the future.

So far I have never managed to obtain any tomatoes which do contain 5 parts of copper per million, and if your correspondent can supply me with any, through you, I should be glad to examine them. At the same time the concentration of tomatoes in purées varies considerably, and it does not follow that those which contain the largest amount of total solids also contain the greatest amount of copper. My experience leads me to believe also that purée containing any appreciable amount of copper always emanates from those factories where the same copper plant has been in operation for years, and these factories can usually reduce this amount if they find it necessary to do so. As a result of many tests carried out, both in my official capacity and on behalf of importers, I have found that a limit of 10 parts per million, as distinct from the 25 parts per million recommended by your correspondent, forms a very satisfactory basis for argument.

In Belgium there are at present many cows yielding milk which falls below our standard of 3 per cent. fat and 8·5 per cent. solids-not-fat, but surely your correspondent would not claim that our legal standard should therefore be lowered to meet the possibilities of any imported milk. In the same way we cannot fix our standards for copper in purée by the maximum amount, which may exist in a few tomatoes, but we can make an allowance if a satisfactory explanation is forthcoming.

I am, Sir, etc.,

Public Analyst.

MAPLE SUGAR . . . .

by E. J. Thomas

STATELY IN its symmetry, the maple is a beautiful tree. The bold crown, a green grandeur in summer, transforms in autumn to a crown of ruddy gold.

In great groves of which even in this day acres still stand untouched and unseen by man, it clothes the land abundantly and gracefully. Its timber, highly prized by workers in wood who appreciate a beautiful grain, is especially valued for the accidental variety known as "bird's-eye maple" and for which it is perhaps best known. Bountifully, too, it yields of its sap, to be boiled down for the natural sugar it contains, the exquisite flavour of which is matchless, and, to those who have once made its acquaintance, unforgettable. Small wonder then that the maple is to Canada as symbolic as the English rose or the Scotch thistle; that "The Maple Leaf Forever" is sung as reverently as our own National Anthem. Yet, among the natural flavour-bearing substances this good earth produces, few are so little known beyond the locality of their origin as the produce of the sugar maple tree.

The origin of maple sugar and the manner of its production is legendary, and there are some pretty stories woven around its beginnings. Of the antiquity of the industry, however, there is no doubt. Long before the first white man set foot on that portion of the North American continent now known as Canada, the Indians were skilled in the art.

It is scarcely surprising therefore that for years the industry should have remained a typical farm occupation. Carried on in the same uneconomic manner as was employed by the earliest settlers on the land, there was as much variation in the quality of the final product as might be expected when the skill of the maker was no less questionable than were his methods.

Earliest Method of Production

Only in the last twenty years or so has any definite advance been made toward standardisation of the process and therefore of the product. In the old days the sap might be gathered in birch bark *casos* or pails. Pailsful of sap would be transported from the depths of the groves by means of the wooden shoulder yoke or a horse-drawn skidded barrel would be dragged from tree to tree to receive—and probably contaminate—the offerings of each. Over a mountainous fire, exposed to smoke and flying wood ash, the sap would be boiled down to the consistency, more or less, of syrup in a ponderous potash kettle. If, towards the completion of the wasteful evaporation, the syrup showed any tendency to froth and boil over the kettle, a piece of fat bacon, possibly both salt and rancid, would quieten it. If the syrup was carelessly overboiled or scorched, the only remedy was to wait patiently for the next year's yield and hope for better luck in processing it!

Under such conditions as these the industry was bound to stagnate, and prior to the Great War years the use of maple wood for furniture became so popular that the sale of timber was far more profitable to grove owners than the production of syrup or sugar. As a result many of the finest stands of this tree were decimated and gradual extinction of the maple sugar industry was feared. With the onset of the war and the tremendous increase at the time in the price of sugar, attention turned to the possibility of the maple relieving the acute shortage of this commodity. The resulting interest paved the way for the introduction of better methods of production. A superior product was thus born which had an appeal so piquant in flavour that the demand for it has steadily developed ever since.

The Modern Method of Production

Modern practice in the production of this article bears little semblance to that of pre-war days. A hole is carefully augured in the tree in a slightly upward direction to a depth of 1½ to 2 inches. Into this hole is driven a metal spile, having as its outer end a hook from which a tinned metal pail, into which the sap drips, is suspended. This operation of tapping the tree is carried out usually early in March when the last of the snows are melting on the ground. The yield, dependent as it is upon the rise of the sap in the trunk of the tree after its winter torpor, is greatly influenced by weather conditions. The season, or the time during which the tree continues to yield sap, lasts for from four to six weeks.

From the pails the sap is conveyed to the sugar house. In the larger groves where quantity production justifies the expenditure on such means, this is effected by temporarily erected pipe lines of non-corrosive metal. Rapid handling of the sap while it is in the raw is an important feature since, in common with other vegetable juices, it is very apt to deteriorate on exposure.

The Process of Syruping

In the sugar house also the process of syruping is carried out as expeditiously as possible. Usually the pipe lines from the groves or sugar bush empty into storage tanks from which the flow to the evaporators is controlled by float feed. The evaporators, many forms of which are used, are mainly similar in principle. Set with partitions to direct a zig-zag flow to the sap, thus exposing a large surface of the liquid for evaporation, a rectangular flat pan with a corrugated bottom set upon a brick arch which is fitted with the usual fire doors, is a popular type of this unit. The sap as it comes from the tree contains only three to five per cent. of sugar. Evaporation to a syrup with a sugar content of sixty per cent. is therefore

obviously costly from the point of view of heat required. As a rule, though, this item does not represent any great actual expenditure, as the sugar house is always situated in close proximity to an abundance of timber which is cut in preparation for the season at odd slack times during the rest of the year.

The Cleansing Process

During the primary evaporation, for the syrup is seldom completed in one operation, a considerable amount of scum rises. This is due to the coagulation of certain constituents of the sap, mostly albuminous in character, and has to be carefully skimmed off. When the last compartment in the evaporator has been reached by the sap—now definitely syrupy, of course—it is allowed to collect and is drawn off at frequent intervals, transferred to a separate vessel and allowed to cool.

At this point a further natural cleansing is effected. The natural minerals in the sap, having been concentrated to a point at which they will no longer remain in solution, crystallise out. That which does not settle out is removed from suspension by straining the syrup through felt. The crystals, chiefly of calcium malate, represent a minor by-product, forty to fifty pounds being obtainable from a thousand trees in a season.

Final Processing

In many cases, so far as the individual grower is concerned, operations cease here. If he has an outlet for his wares, such as a local market, he will, of course, complete the process and fill and label his containers on the scene. More frequently, though, the syrup is shipped to some central depot for further processing and release for sale as Government standard commercial maple syrup or sugar. Received at the depot, the syrup is weighed and graded according to colour. For syrup, four official grades obtain —for sugar, three. The highest grade syrup should look very much like best clover honey in colour, the darker shades being considered slightly inferior.

The most modern plant, capable of handling the season's combined output of numbers of growers, now takes up the process. But little remains to be done in the case of syrup beyond a further evaporation until the sugar reaches a concentration of sixty-five per cent., when it is filled into containers of various sizes, sealed, and labelled ready for shipment.

Maple sugar *alias* maple concrete is, of course, the solid form of the syrup which has been subject to a further reduction in its water content to ten per cent. Much of it is marketed in blocks of varying size. Some of it is granulated, for the production of which form centrifugal spinning necessarily enters the process, and some of it is pulverised.

Location of the Industry

The industry is peculiar to the Western Continent and is confined to a relatively small area of it. The entire world's supply originates in the states of Vermont, New Hampshire, and Maine, in the United States, and in Canada in the provinces of New Brunswick, Nova Scotia, Ontario, and Quebec. Quebec alone produces nearly one-half of the aggregate. As expressed in terms of sugar, the annual Canadian output amounts to approximately 24,000,000 pounds, and of this amount about twenty-five per cent. is exported to the United States. Gradually ousting the use of molasses for the purpose, maple syrup fills the dual rôle of moistener and flavour in the blending of tobaccos.

To the producer the average value of maple syrup is about 5s. 6d. to 6s. per gallon of thirteen pounds two ounces, and that of the concrete about 6d. per pound. Although subject to great fluctuation from year to year, the economic value of the industry to the Dominion is therefore considerable.

Uses of Maple Sugar and Syrup

A large proportion of the syrup finds a domestic use similar to that of our own well-known golden syrup, its most popular use being the sweetening of such—to the Englishman—weird breakfast comestibles as pancakes. But of late years there has been a very perceptible growth of its popularity as a flavour in wider fields. Ice-cream, confectionery, and baked goods are edibles in which as a "new" flavour the maple has found great favour.

In many cases the use as a flavour of either the syrup or the sugar entails a special technique, frequently involving the recasting of formulæ. Particularly is this true of the "straight" or commercial syrup, which to its sweetening power bears a rather small flavouring ratio. A sufficient depth of flavour, especially in those products that are subject to extremes of temperature, is difficult to obtain. To cite the case of ice-cream, even if the normal sugar content of the batch is entirely replaced by its equivalent in maple sugar, the resulting flavour—subject to the well-known propensity of ice-cream flavours for "freezing out"—gives disappointing results. To add more maple sugar with the object of improving the flavour is to raise obvious difficulties. Of these, alteration of the percentage composition of the batch, over-sweetening the mixture and undue lowering of the freezing point of the batch, might be mentioned.

The natural reply to such difficulties is the use of a concentrate. Maple, however, is one flavour that has proven somewhat intractable in this direction, and the buyer of this had better be wary. The number of true maple concentrates is vastly outnumbered by those that are either partly or wholly fortified by such foreign flavours as burnt sugar or fœnuegreek. In buying a concentrate of maple, if fidelity of flavour is desired, it is hopeless to expect a concentration of flavour exceeding threefold that of the commercial syrup. This apparently low concentration is quite sufficient to mitigate most, if not all, of the problems peculiar to the use of this flavour. To the choice of the concentrate to be used, one final tip might be given. The colour is a good index of the purity of the product. The lighter it is the relatively finer—more delicate—will be the resulting flavour, and it is to the manufacturer of better goods that this point will appeal.

DIFFERENTIATION OF STARCHES

It is frequently necessary to distinguish between various starches. The identification of pure starches by microscopic examination is fairly simple to an experienced observer owing to the characteristic shape of the starch granules. When one is dealing with mixtures of starches the microscopic examination becomes more difficult, and the detection of adulteration of wheat flour with, say, small amounts of rice is not so simple. Recently Bhargava and Giri have contributed a paper to the journal of the Indian Institute of Science in which an extremely interesting method for detecting cereal flours separately and in mixtures is described. Two years ago Giri suggested a method for the differentiation of pure starches by the characteristic coloured zones which are produced when the starches are impregnated in an agar medium and flooded with iodine after hydrolysis with amylase. This method gave such good results with pure starches that it was applied to mixtures of starches.

The Method

A known amount of flour is taken so that the final concentration of starch in the agar medium is 0·4 per cent. The flour is introduced into a beaker in which water is kept boiling. This is to prevent the partial hydrolysis of the starch by the enzyme which is present in the flour. The solution is kept boiling for a minute subsequent to the addition of the flour, cooled and filtered through muslin. The agar medium is made by autoclaving known amounts of agar in water. The concentration of agar gel is such that its concentration in the final agar medium is 1 per cent. Before mixing with the flour extract the hydrogen ion concentration is adjusted to 4·6 by adding 0·2 N acetate buffer for malt amylase and taka-diastase and to 6·8 by N/15 phosphate buffer for salivary amylase. The agar gel, while still warm, is mixed with an equal volume of flour extract and transferred to petri dishes. A small drop of amylase (saliva 1 : 5 dilution, taka-diastase 0·1 per cent.) is dropped on the centre of the plate and allowed to diffuse at laboratory temperature for 24 hours. The surface is then covered with N/200 iodine. In a few minutes the colours of all zones have developed.

The Results

The results show that various cereal flours have characteristic colour zones and, moreover, the diffusion zones developed by different types of amylases are different in their intensity of colour and width of zones. For example, wheat with salivary amylase gives a central colourless zone surrounded by a deep blue zone. Malt amylase, however, gives a central deep green coloured zone surrounded by a diffused violet zone, whereas taka-diastase produces a central blue zone surrounded by a streak of violet. Maize, jowar and bajra behave like wheat. Rice, ragi and barley behave differently. With malt amylase these give a central deep blue zone instead of the deep green one in the former group. The differences are so marked that flours belonging to one group can be easily differentiated from those of the other groups by their characteristic colour zones. The method is useful not only when the flours are in their natural state but also when the structure of the starch colloid is destroyed by cooking. Hitherto no such method has been available. This is very important owing to the increasing use of prepared foods. Adulteration can be determined microscopically in ordinary flours, but the microscope is useless with cooked foods.

THE NATION'S FOOD

Sir Kingsley Wood has described the report of the Government's Advisory Committee on Nutrition as "the most valuable document that has yet been issued on nutrition." Moreover, he goes on to say that he is immediately taking steps to act upon the recommendations of the report. The Committee makes significant reference to the current "Fitter Britain" campaign, and reminds the Government that all the "physical jerks" in the world will not avail unless nourishing diet also receives attention.

Apparently the country is still only consuming 60 per cent. of the recommended quantity of milk, slightly less than before the war. There has been an astonishing increase in the consumption of fruit, butter, vegetables and eggs. The Committee are emphatic that no single step could achieve so much towards the nation's fitness as increased consumption of milk. They deplore the wastage of skimmed milk, and refute the idea that this is valueless as a food just because the fat has been removed. They suggest, incidentally, that this type of milk might best be distributed in dried form; if this could be done economically there appears to be an opportunity here for an enterprising manufacturer and an outlet for a "waste" product. Herring and mackerel are also recommended as highly nutritious foods.

A curious fact which has been brought to light is that consumption of the more expensive foods tends to rise with income, while that of the cheaper staple foods remains constant. This appears to indicate that there is a general feeling that in order to achieve a higher state of nutrition it is necessary to spend more money.

To sum up the report, much has been done to improve the nation's diet, but much remains to be done, and one of the most urgent measures is to increase the consumption of milk and milk foods.

INFORMATION and ADVICE

Horseradish Sauce—Sausage Bands—Tomato and Apple Pulp—Jellied Eels—Glacé Cherries—Beef Extract—Fruit Juices—

Horseradish Sauce

2,102. *One of our clients desires to make some horseradish sauce from dried, grated horseradish, and we will be glad if you will let us have the necessary information.* (London.)

Herewith we have much pleasure in giving you a formula for horseradish sauce, with which your client can experiment:

Horseradish (dried and grated) ..	20 lb.
Corn meal	20 ,,
Sugar	30 ,,
Salt	3 ,,
Condensed milk (unsweetened) ..	5 ,,
Gum tragacanth	2 ,,
Mace, ground	4 ,,
Pale vinegar (16 grain)	20 ,,
Egg yellow colour.	

Soak the gum in 2 gal. of the vinegar for 48 hours. Add another 2 gal. of vinegar and stir well.

Soak the horseradish in 6 gal. of the vinegar for 48 hours.

Place the corn meal in a tub and mix with sufficient vinegar to make a thick paste.

Put the rest of the vinegar into a steam-pan and add the sugar, salt and mace.

Bring to the boil.

Cut off the steam and add the horseradish and gum by rubbing them through a fine sieve. Add the corn meal. Boil and stir well. Colour a bright yellow.

Pass through a flat stone mill or homogeniser. Bottle at not less than 185° F. If filled cold, sterilise for 1 hour at 195° F.

Sausage Bands

2,103. *Would you inform us as to what regulations there are governing the design and shape of sausage bands?* (Rochdale.)

If the sausages contain a preservative they must bear a label on which this is stated in letters $\frac{1}{8}$ in. in size, surrounded by a black border. This is the only regulation we know of.

Tomato and Apple Pulp

2,104. *We are seeking information on the preserving of tomato pulp and apple pulp. Our usual practice is to pulp the tomatoes and apples in 4-gal. tins. We have had satisfactory results with this, but we are desirous of ascertaining whether, for the coming season, we could with the same satisfaction pulp in 40-gal. wooden casks. In our pulping we do not preserve the pulp, but our sauce is preserved with benzoid acid solution. Would it be necessary, if we were using wooden barrels, to preserve with benzoic acid? If this course were adopted, would we require to add further preservative to the same when being manufactured, and if so, how much addition? We would also appreciate your advice as to whether both tomatoes and apples may be pulped in barrels or whether either one would be more satisfactory.* (New Zealand.)

Your manufacturing charges would be considerably reduced, and a more uniform product would be obtained if you did your pulping in 40-gal. casks. The procedure is as follows:

Fill the cask (the head of which has been removed) about two-thirds full with tomatoes or apples, and add a gallon or two or water. Blow in live steam through a perforated steam coil in the bottom of the cask until the fruit is thoroughly soft. Sieve it whilst hot, either through a fruit pulping machine or by hand, into another cask, where the requisite quantity of benzoic acid is stirred in (about 300 parts per million). When the cask is full of pulp, the head should be replaced and the cask set aside in a cool place. This may then be used as required in the manufacture of sauce, but the amount of benzoic acid in the pulp must of course be allowed for.

In connection with the use of such pulp, in sauces, we should like to point out that where benzoic acid is present, it is necessary, in order to comply with the regulations, to state this clearly on the bottle. Further, the amount of benzoic acid present should not be greater than 250 parts per million. Tomato or apple pulp, preserved with benzoic acid, may not be sold as such, since sulphur dioxide is the only preservative permitted for fruit pulps. However, as you are intending to use this for sauce, to which you would normally add benzoic acid subsequently, we see no reason why benzoic acid should not be used as recommended.

Jellied Eels

2,105. *We would be pleased if you would let us have some recipes for the preparation of jellied eels.* (Cheshire.)

1. Small and medium-sized eels are selected, and after the heads, skins and viscera have been removed they are cut into suitable lengths and placed on wire trays and cooked in a steam retort for 20 to 30 minutes. They are then placed in cans either plain or with a small amount of jelly to hold them firmly together. The cans are then sealed and exhausted for about 10 minutes at 212° F., and processed for about 90 minutes at 240° F. NOTE.—No exhausting is necessary if product is packed hot.

The jelly can be made by dissolving isinglass in water

24 hours before being required and clarifying. Add salt and spices to taste, and flavour with port or sherry wine.

2. Skin the eels, remove their heads and tails, and wash in salted water. Cut into pieces about 2 in. long, and put in a stew pan with a bay leaf, parsley, sage and a shallot, a wineglassful of white wine, half the quantity of vinegar and a small quantity of water. Season with salt and pepper, put on the lid, and cook gently until tender. Remove and leave in the pan until quite cold, keeping them covered. Put the pieces of eel round the sides of a mould with the ends towards the centre, cover with jelly, and place mould in a cool place.

Glacé Cherries

2,106. *We are proposing to put down a quantity of cherries for glacé work. We have a cement tank in our works, which we should like to use for storage. Will this cement tank be suitable for our purpose, and what solution would you recommend in which to put the fruit?* (Kent.)

For the glacéing of fruit it is copper tanks or dish pans which are generally used. However, if your cement tanks are in good condition with a hard, smooth surface there is no reason why you should not employ them, providing also that you make suitable arrangements for draining out the liquor.

A special article on the "Bleaching, Dyeing and Glacéing of Cherries," by F. E. Atkinson and C. C. Strachan, was published in the August, 1936, issue of FOOD MANUFACTURE, on page 287, and we would recommend you to consult this article.

After bleaching and dyeing, should you be intending to do this, the cherries are placed in a 30 per cent. syrup to which citric acid is added at the rate of 10 oz. per 250 lb. of fruit after 24 hours to set the dye. The syrup is gradually increased until a final sugar concentration of 75 to 76 per cent. is attained. Fruit should be thoroughly glacéd in 7 days, the daily increase in strength of the syrup is usually 10 per cent.

Beef Extract

2,107. *We would be grateful if you could inform us what percentage of beef is necessary to be contained in a liquid extract for it to be marketed as "beef extract."* (Birmingham.)

There is no legal ruling regarding the percentage of beef necessary to be contained in a liquid or fluid extract, but such fluid extracts usually contain about 52 to 65 per cent. of water and give a total ash content of 9 to 22 per cent. The remainder should consist of the nitrogenous products from the meat.

Obviously the beef extract must be made entirely from beef, and it must be in such a condition that it will keep. A small quantity of salt can be added to assist the keeping quality, the quantity being consistent with flavour. It is usual to assume that a liquid extract will contain the coagulable proteins of the meat.

A good extract is made from the best parts of the beef and not from offal. An extract which contains a large quantity of salt should only be sold as a seasoning.

Fruit Juices

2,108. *Would you please let us know what quantity of sodium benzoate is necessary for preserving fruit juices?* (London.)

It is generally advisable to use the maximum amount of sodium benzoate permitted by law—*i.e.*, 600 parts per million. The reason for going right up to the limit is that in a number of cases it has been found that certain yeasts and bacteria which are not effectively suppressed by this chemical are liable to be present. There does not seem to be any clear-cut distinction between fruit products which are effectively preserved by benzoate, and those in which sulphur dioxide is preferable, and as the benzoate compound is not noticeable to the taste it is considered advisable to use the full quantity. Considerable differences of opinion have been expressed by food chemists as to the advantages possessed by sodium benzoate and sulphur dioxide, but for liquid fruit products in general sulphur dioxide appears to be the more efficient preserving agent, and its use is advisable except in special cases where the taste of the chemical is likely to affect the ultimate flavour of the product. 350 parts per million of sulphur dioxide are allowed by law, and this compound is generally added in the form of potassium metabisulphite (K.M.S.).

Materials and Equipment Required

Enquiries have been received concerning suppliers of the following materials and equipment, and suitable recommendations have been made:

2,109. *Pharmaceutical malt extract.* (Newfoundland.)

2,110. *Preserved ginger in tanks or barrels, suitable for the manufacture of ginger marmalade.* (Belfast.)

2,111. *Shelled Brazil nuts.* (Plymouth.)

2,112. *Treacle suitable for ham-curing purposes.* (Worcestershire.)

2,113. *Mustard, yellow colour, for pickles.* (Norway.)

2,114. *50-gal. steam-jacketed pan.* (London.)

2,115. *Grinding and mixing machines working on the drum-and-shot principle suitable for grinding lump chemicals into fine powder.* (Reading.)

2,116. *Machine for plucking fowls.* (London.)

2,117. *Machine for filling jars with substances having the consistency of yeast extract.* (London.)

2,118. *Machine for packing powder into tin containers and weighing same.* (London.)

2,119. *Roasting drum for chicory.* (London.)

2,120. *Machine suitable for filling malt extract.* (Burton.)

2,121. *Machine for filling paste.* (Burton.)

2,122. *Tinfoil, boxes, cups and glassine paper.* (British Guiana.)

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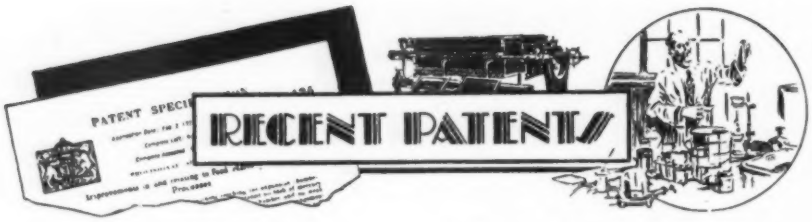

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Latest Patent Applications

5405. BARNES, H.: Food preparation. February 23.
5569. GLAXO LABORATORIES, LTD., REYNOLDS, S.: Production of activated gelatine preparations. February 24.
5587. PROTEX GES.: Production of malt enzymes. February 24.
5585. KELLOGG CO.: Manufacture of puffed cereal food. February 24.
6424. TALLGREN, H.: Preserving foodstuffs, etc. March 4.
6446, 6447. KELLOGG CO.: Manufacturing prepared cereal food, etc. March 4.
6572. BUSH, R. W. (BUSH): Fruit juice extracting machines, etc. March 5.
6722. CERECEDO, L. R.: Antineuritic vitamin. March 6.
6759. PARCUS, G.: Coffee vending device. March 8.
6763. CIGARINI, A.: Confectionery. March 8.
6870. INTER-BREVEX AKT.-GES., ERZINGER, J.: Apparatus for beating cream, etc. March 9.
6871. PATENT CO., LTD.: Manufacture of malt extract for use in baking, etc., trade. March 9. (France, March 11, 1936.)
6878. BAAR, H., LAHNER, M.: Preserving meat. March 9.
6990. FAIRRIE, J. L.: Preparing foodstuff. March 10.
7896. HALÁSZ, S.: Production of oats preserve in form of briquettes. March 17.
7962. FAIRWEATHER, H. G. C. (COFFEE PRODUCTS CORPORATION): Manufacture of concentrated coffee extract. March 18.
8000. POLLAK, J. E. (INTERNATIONAL PATENTS DEVELOPMENT CO.): Production of flexible protein products. March 18.
8090. VICKERS, H.: Preserving foodstuffs in sealed containers. March 19.
8402. DUVAL, M. H., VEZIN, R.: Cooling bakery products. March 22.
8429. DONOVAN, F. K., PFIZER AND CO., C.: Production of anhydrous citric acid. March 22.
8498. MATLOW, A. B., MATLOW, M.: Sweetmeats. March 23.
8542. HALTON, P.: Determining baking qualities of cereal flour dough. March 23.
8547. BRITISH ASSOCIATION OF RESEARCH FOR THE COCOA, CHOCOLATE, SUGAR CONFECTIONERY, AND JAM TRADES, CAMPBELL, L. E., MACARA, T., and STAINSBY, W. J.: Preservation of oils, etc. March 23.
8610. NEVANAS, S. V.: Preservation, etc., of perishable foodstuffs. March 24.
8654. PERESS, J. S.: Preserving, etc., foodstuffs, etc. March 24.
8830. MARSHALL'S TEA MACHINERY CO., LTD., THORPE, T. S.: Manufacture of tea leaf. March 25.
9045. FOOD DEVICES, INC.: Producing aerated food products. March 30. (United States, April 9, 1936.)
9116. CARBO-NORIT-UNION VERWALTUNGS GES.: Removing objectionable smell, etc., from flour, etc. March 31. (Germany, April 3, 1936.)

Complete Specifications Accepted

462,156. VOGT PROCESSES, INC.: Apparatus for making bars of frozen comestible material.
462,170. JOHNSON, G. W. (I.G. FARBENINDUSTRIE AKT.-GES.): Colouring foodstuffs.
462,354. BROOKE, BOND AND CO., LTD. (WALKER, F.): Tea-withering lofts. (July 31, 1935.) (Divided out of 21758/35.)
462,653. BURGESS, A. F. (LIBBY, McNEILL, AND LIBBY): Process of preparing a food product.
462,986. SAGI, DR. J.: Manufacture of bakery products.
463,049. KREMMLING (GEB. FUCHS), J.: Dough-moulding machines. (October 8, 1934.)
463,060. ROWLES, A. H., and BARRON AND SON, LTD., W. S.: Drying and conditioning of cereals and other substances.
463,064. MAY AND BAKER, LTD., and BLENKINSOP, E. K.: Scale pans.
463,080. GENTELE, J. G. W.: Method of and apparatus for drying substances *in vacuo*.
463,113. CHOPIN, M. J. E.: Mixing and testing of dough, pastes, and other plastic materials. (March 28, 1935.)
463,897. LYONS AND CO., LTD., J., and COHEN, V. L.: Regeneration of bakery products. (Divided out of 22661/35.)

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

Abstracts of Recent Specifications

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume, or in bound volumes price 2s. each.

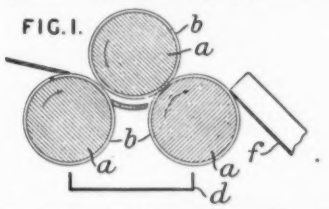
455,691. **Butter; cheese.** WEISSENBERG, H., 16, Wilhelmstrasse, Gleiwitz, Upper Silesia, Germany.
Cheese is made from skimmed milk, or butter and cheese are made from whole milk or cream, by adding a quantity of citric acid just sufficient to curdle the casein therein, butter being next made and separated off where whole milk or cream is used, the buttermilk or the curdled skimmed milk being finally heated to agglomerate the casein and produce cheese curds. In an example citric acid is added to whole milk to the extent of about 5 gm. per 1,000 c.c. of the milk which is at room temperature; after standing about 15 minutes the coagulated milk is churned and the butter removed and washed and salted. The buttermilk is heated to about 42° C. and the curds separated by straining in a warm room containing fairly moist air. Where an increased fat content is desired in the cheese, whole milk or cream is added to the buttermilk. The milk used may first be pasteurised or boiled, and may be cow's or goat's milk.

457,751. **Butter manufacture.** E. SPIEKER, 3, Menselstrasse, Munich, Germany.
Butter produced with the aid of bacterium bulgaricum (yoghourt ferment) or similarly acting cultures of bacillus acidophilus is claimed to have more health-giving properties than that commonly produced with streptococcus cremoris. An acidulating agent for cream to be used in making yoghourt butter is prepared from a milk culture of the genuine yoghourt ferment, which is added to centrifuged milk (50 c.c. per 2 litres skim milk) which has been pasteurised at 90° to 95° C. and then cooled to 45° C. After thickening at 41° to 42° C. for 2 to 3 hours the product is cooled to 8° C. and kept in a cold place till used on the following day. The cream (18 to 22 per cent. fat content), pasteurised at 90° to 95° C. and cooled to 45° C., is then treated with 3 to 4 per cent. of the acidulating agent, with which it is well stirred and allowed to ripen at 41° to 42° C. When an acidity of 28 to 30 S.H. is reached (after 2 to 2½ hours), the cream is cooled to 6° C. and kept at this temperature till the butter is to be made. The latter process, which is preferably carried out at a temperature not exceeding 12° to 15° C., occupies about 45 minutes. The buttermilk should be drawn off as soon as globules of pinhead size appear, and the butter then washed with sterilised water at its own temperature. Extreme cleanliness and weekly renewal of the acidulating agent are conditions for production of a high quality butter. The resulting yoghourt butter has an attractive acid tang, but the flavour does not otherwise differ greatly from that of ordinary butter. (Convention date, Germany, August 22, 1935.)

457,789. GROUP VI. **Food preparations; medicines.** GOODALL, C., Park Lane, Tutbury, Burton-on-Trent.
Fresh grass is subjected simultaneously to a cutting, lacerating, or like operation which serves to facilitate the removal of entrapped juices, and to a squeezing operation which effects removal of the said juices. As shown, the grass is passed between heavy rollers *a* formed with circumferential V-shaped ridges *b*, the ridges of one roller registering with the troughs of the adjacent roller. The juices collect in the sump *d*, and the grass is dis-

charged over the shoot *f*, from whence it is taken to a hot-air drier. The dried grass is then baled or otherwise stored. The juices contain chlorophyl, vitamins,

FIG. I.



and ferments, which are extracted by any suitable means. The juices may be evaporated to dryness or partially evaporated, the product being used for nutritive or medicinal purposes. According to the provisional specification, vegetable substances other than grass may be treated. Grass is first passed through a mincing machine like a chaff cutter, wherein it is cut into short lengths and crushed. The product is then passed to a screw-operated squeezer to separate the juices. The grass may merely be crushed by the squeezer.

458,163. **Cleaning Metals.** HENKEL AND CIE, GES., 67, Heyestrasse, Holthausen, Düsseldorf, Germany.

Deposits and incrustations—*e.g.*, beer scale, milk scale, etc.—on apparatus used in the foodstuffs and table luxuries industry are removed by treating the affected surface with an aqueous solution of one or more acid-reacting stable nitric acid salts of organic compounds containing an NH_2 group; for example, the nitrates of urea and thiourea. The nitric acid liberated reacts with the incrustations, and the organic bases react with the decomposition products of the acid and prevent the liberation of oxides of nitrogen. Instead of using solutions of preformed salts, organic compounds containing an NH_2 group may be added to nitric acid solutions, the amount added being determined by the amount and nature of the deposit to be removed. The solutions may be made into pastes by the addition of inert agents such as infusorial earth or kieselguhr, and may contain other substances having a neutral or acid reaction—for example, salts such as potassium sulphate—anti-corrosion agents, and wetting agents such as naphthalene-sulphonic acids, alkylised naphthalene-sulphonic acid, or alkylised tetrahydronaphthalene-sulphonic acid. Organic compounds which may be added to nitric acid to form the cleaning solutions include primary aliphatic, cycloaliphatic, aromatic, and heterocyclic amines, substances having a plurality of amino groups, such as ethylene diamine, amino compounds with other substituents such as taurin, amino acids such as glycocoll, alanine, and leucine, and amino compounds of dicarboxylic acids—for example, asparagic acid. Acid amides and sulphonamides—for example, formamide, acetamide, benzoic acid amide, benzene or toluene sulphonamide, urea, thiourea, and guanidine—may be used, and also substances such as dinitrosodiphenylamine. Salts and additive compounds of any of the above substances may be employed. All the compounds react with oxides of nitrogen to form innocuous substances—for example, with the evolution of nitrogen—diazo compounds being formed as intermediate products in some cases. Examples of specific cleansing compositions are given.

458,399. **Concentrated milk products.** SOC. D'ÉTUDES AND APPLICATIONS INDUSTRIELLES, 12, Avenue Fraisse, Lausanne, Switzerland.

A method for effective distribution of vitamins in sweetened milk concentrates (block, powder, paste, etc.) is based essentially upon addition to the fresh milk of separate emulsions of fat-soluble and water-soluble vitamins in concentrated sweetened milk. The latter is adapted for maintaining large quantities of vitamin-containing oils (fish oils) in permanent suspension. Cod liver oil emulsified with concentrated sweetened milk remains homogeneous on dilution.

In applying the process, fish oil (cod liver or halibut liver), deodorised if required, is emulsified by vigorous stirring with a small quantity of concentrated sweetened milk. This is mixed with fresh or pasteurised milk and sugar added while concentrating. Vitamin C emulsified with concentrated sweetened milk in the required quantity may also be added during boiling, in the form of ascorbic acid or fruit juice. (Convention date, Switzerland, November 14, 1934.)

LATEST TRADE MARKS

BLUE SPOT.—574,102. **Eggs, lard (for food), and margarine.** I. BEER AND SONS, LTD., 15, King Street, West Smithfield, London, E.C. 1. March 31.

Registration of this trade mark shall give no right to the exclusive use of the letters "W.S.E."

The trade mark is limited to the colours blue and white, as shown in the representation on the form of application.

COYKITTIE. — 575,165. **Canned fruits, canned fish, canned meats, and canned vegetables.** ANDERSON AND COLTMAN, LTD., 5, Philpot Lane, London, E.C. 3. March 24.

Registration No. 313,953 (1638) will be cancelled if and before the applicants' mark is registered.

DAIRY BELLE.—575,543. **Butter.** MIDLAND COUNTIES DAIRY, LTD., Corner of Corporation Street and Bagot Street, Birmingham, 4. March 31.

DOL-ITE. — 572,692. **Edible oils and edible fats.** ARMOUR AND CO., LTD., Armour House, St. Martin's-le-Grand, London, E.C. 1. April 7.

FORTIS. — 575,487. **Condensed milk.** MACPHERSON, TRAIN AND CO., LTD., Adelaide House, London Bridge, London, E.C. 4. April 7.

Condensed milk and goods of the same description will be struck out from the goods of Registration No. 371,228 (1986) if and before the applicants' mark is registered.

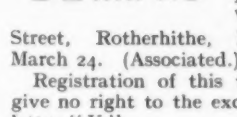
GRANTAMEDE.—574,101. **Milk products for food.** MELTON MOWBRAY DAIRIES, LTD., 39, Victoria Street, London, S.W. 1. March 17.

HOMOGEL.—573,692. **Emulsifying liquids (not medicated, not aerated, and not alcoholic) for use in making fruit beverages and being ingredients therein.** THE LONDON ESSENCE CO., LTD., Lofresco Works, 53, Glengall Road, Peckham, London, S.E. 15. March 24. (Associated.)

KIMPRO.—574,334. **Edible fats for use in the manufacture of bread, cakes, and pastry.** KIRBY'S REFINERIES, LTD., Albion Works, Clack Street, Rotherhithe, London, S.E. 6. March 24. (Associated.) (By Consent.)

Registration of this trade mark shall give no right to the exclusive use of the letter "K".

L.B.W. — B 574,909. **Lemon-flavoured barley water.** L.B.W., LTD., 41, EASTCHEAP, London, E.C. 3, and The Lynch, Uxbridge, Middlesex. March 17.



User claimed from March 10, 1934.

The applicants undertake that this mark, when registered, and the mark No. 556,895 (2968) shall be assigned or transmitted only as a whole and not separately.

NOVEL. — 572,025. **Tea and coffee.** SAMUEL BUDGETT AND CO., LTD., Ocean House, 24 and 25, Great Tower Street, London, E.C. 3. March 31. (By Consent.)

Registration of this trade mark shall give no right to the exclusive use of the word "Novel".

ORIENT. — 569,839. **Tea, coffee, rice, ground rice, tapioca, peas (for food), currants, sultanas, and custard powder.** T. COLLINSON AND SONS, LTD., St. John's Warehouses, 6 and 8, St. John's Place, Halifax, Yorkshire. March 24. (Associated.)

All goods except cocoa, cocoa preparations (for food), chocolates, chocolate confectionery, and sweetmeats will be struck out from the goods of Registration No. 454,954 (2461) if and before the applicants' mark is registered.

NEW COMPANIES

Alfred Beaumont, Limited. (323,421.) Registered January 23, 1937. To take over the bus. of grocers and provision mchts. cd. on by A. Beaumont at East Street Mills, East Street, Leeds, and elsewhere. Nom. Cap.: £30,000. Dirs.: A. Beaumont, Parkfield, Newton Road, Leeds (permt. gov. dir. and ch.); Clara A. Beaumont and Gwendoline E. Beaumont, ditto; L. Storr, 48, Talbot Gardens, Leeds; S. Temple, 47, Gipton Wood Place, Leeds. Qual. of gov. dir. and ch.: £500 shares. Remun. of dirs.: As voted by company.

Brettells Bath Hotel, Limited. (325,196.) Bath Hotel, Bath Street, Birmingham. To carry on the bus. of hotel proprietors, etc. Nom. Cap.: £20,000. Dirs.: C. O. Brettell, 57, Vicarage Road, Kings Heath, Birmingham; Maud A. Brettall; V. I. Olliver.

Candycraft, Limited. (325,575.) Junction Works, Carmichael Road, South Norwood, S.E. 25. To carry on the bus. of mnfrs. of and dlrs. in chocolate and confectionery, etc. Nom. Cap.: £10,000 in 9,950 pref. shares of £1 and 1,000 ord. of 1s. Dirs.: E. C. Roberson, 12, Forest Ridge, Beckenham, Kent, and C. G. Moss, Dalry, Clive Road, Esher, Surrey.

Castleton Tea Estate Company, Limited. (325,313.) To take over the bus. of tea planters cd. on at the Castleton Tea Estate, Kurseong, Bengal. Nom. Cap.: £10,200 in £1 shares. Dirs.: Mrs. E. M. Young, Worth, near Tiverton, Devon; Mrs. J. M. Hollington, Chequers Mead, Potters Bar, Middlesex; Mrs. H. E. Budenberg, Oaklands, Arthog Road, Hale, Cheshire.

Confectionery Buying Trust, Limited. (325,434.) To carry on the bus. of mnfrs. of and dlrs. in goods, stores, provisions, confectionery, etc. Nom Cap.: £50,000 in £50 shares (all founders'). Dirs.: L. G. Hughes, Springfield, Tottington, Bury; E. K. Gregory, Red House, Bromley Cross, near Bolton; J. N. Edington, Eltonbury, Highfield Road, Timperley, Ches.; G. W. Turner, Norman Lodge, Norman Road, Wrexham; A. Steedman, 17, Burlington Avenue, Glasgow; A. J. Bolton, 107, Hayes Lane, Bromley, Kent.

W. H. Day and Sons, Limited. (325,156.) 303, Heathway, Dagenham. To carry on bus. as tobacconists, confectioners, etc. Nom. Cap.: £5,000. Dirs.: W. H. Day, 30, Parkstone Avenue, Emerson Park, Hornchurch, Essex (ch. and permt. dir.); S. W. Day, 21, Canterbury Avenue, Cranbrooke Park, Ilford; G. H. Day, 1, Byran Mansions, Corbets New Road, Upminster.

Don Trawling Company (Milford Haven), Limited. (323,654.) Registered January 29, 1937. To carry on the bus. of fish and ice mchts., etc. Nom. Cap.: £15,000. Permt. dirs.: J. C. Llewellin, The Docks, Milford Haven; J. Iriarto, Calle San Murcial, 40-42, San Sebastian, Spain; F. Ordinas, address not stated.

Grant and May, Limited. (325,508.) 5, Billingsgate, E.C. 3. To take over the bus. of fish factors and salesmen cd. on by Grant and May, Ltd., at Billingsgate, E.C. Nom. Cap.: £12,000 in £1 shares.

Walter Green and Sons, Limited. (324,690.) Registered February 25, 1937. Castle Mills, Beccles, Suffolk. To take over the bus. of flour millers, etc., cd. on at Castle Mills, Beccles, as "Walter Green". Nom. Cap.: £30,000. Permt. gov. dirs.: W. S. Green, Castle Mills, Beccles; A. S. Green, Castle Mills, Beccles.

Leonard Fletcher, Limited. (324,845.) To carry on the bus. of restaurateurs, fish shop proprietors, etc. Nom. Cap.: £2,000. Permt. dirs.: E. Wainwright, 196, Birkby Hall Road, Huddersfield; A. Tankard, 33, Carlton House Terrace, Halifax.

Leward, Bibby and Company, Incorporated. (F.3,432.) Particulars filed February 22, 1937. 7, Birchin Lane, E.C. 3. Incorporated in New York, December 18, 1936. Formed to act as commission agents, dealers in sugar, molasses, etc. Nom. Cap.: $250,000. Name of person authorised to accept service: E. G. Greener, 7, Birchin Lane, E.C. 3.

Mash and Murrell, Limited. (323,688.) Registered January 29, 1937. To carry on the bus. of fruit, nut, potato, and vegetable salesmen, etc. Nom. Cap.: £10,000. Permt. dirs.: J. M. Mash, 11, Barham Road, S.W. 20 (mng. dir.); W. P. Murrell, 97, Cranley Gardens, N. 10 (mng. dir); M. Mash, address not stated.

Morgans (Wholesale Grocers), Limited. (324,789.) To carry on bus. as wholesale grocers, etc. Nom. Cap.: £3,000. Dirs.: Evelyn L. V. E. Morgan, address not stated; G. A. Morgan, address not stated; R. S. Yates, 199, Piccadilly, W. 1.

F. L. Morris and Company, Limited. (324,875.) County Cold Stores, Abingdon Square, Northampton. To carry on bus. as wholesale meat salesmen, etc. Nom. Cap.: £5,000. Dirs.: S. R. Lovell, 30, Christchurch Road, Northampton (permt.); T. Horn, 121, Clare Street, Northampton (permt.); H. H. Old, 12, Highlands Avenue, Northampton.

J. H. Northover and Sons, Limited. (325,537.) 34, St. Thomas Street, Weymouth. To carry on the bus. of grocers, provision mchts., etc. Nom. Cap.: £5,000 in £1 shares. Dirs.: J. H. Northover (permt. ch. and gov. dir.) and L. J. Northover, both of 11, Evelyn Terrace, Wyke Regis; and S. J. Northover, 45, St. Thomas Street, Weymouth.

Norwich Dairy Supply, Limited. (324,724.) To take over the bus. of a dairyman cd. on by Leah P. Jeffries at 81, Prince of Wales Road, Norwich. Nom. Cap.: £5,000. Dirs.: P. W. Johnson, 9, Judge's Walk, Norwich; A. W. Gowing, Kempton Farm, Hevingham, Norwich (permt. mang. dir.).

Nuvec Products, Limited. (323,839.) Registered February 3, 1937. To acquire any formula relating to the manufacture of food or food extracts, etc., and to acquire the trade mark "Nuvec". Nom. Cap.: £2,000. Subs.: S. M. Gershon, 136, Notting Hill Gate, W. 11; H. W. Hicks, 25, Southampton Street, W.C. 2 (solr.).

Orchard Products (Wisbech), Limited. (325,283.) Lloyds Bank Chambers, Wisbech. To take over the bus. of fruit juice mnfrs. cd. on by the Cambridgeshire Fruit Juice Co., Ltd., at Cambridge. Nom. Cap.: £20,000. Dirs.: H. A. Harvey, Cambridge; C. C. Kline, 31, Park Avenue, Bedford; H. M. Freund, D.Sc., Brown Farm, Elsworth, Cambs.; F. F. Parsons, Wellingborough; F. J. Smith, Wisbech.

E. Redapple, Limited. (323,707.) Registered January 30, 1937. To carry on the bus. of confectioners, etc. Nom. Cap.: £4,000. Permt. ch.: W. Richards, 67, Underhill Road, East Dulwich, S.E. Qual. of permt. ch.: £100 shares. Subscriber: H. Harrison, 6, Hanover Park, Peckham, S.E. 15 (accnt.).

St. Helier's Bakeries, Limited. (324,287.) Registered February 15, 1937. To carry on bus. as bakers, confectioners, etc. Nom. Cap.: £2,000. Dirs.: E. J. Heddercott, 51, High Street, Hounslow, Middlesex, and A. G. Littlewood, 13, Whitton Manor Road, Twickenham, Middlesex (both permt.).

Sir John Francis, Limited. (322,867.) Registered January 7, 1937. 60, Cheapside, E.C. To take over the bus. cd. on by a company of the same name at London and elsewhere; to carry on the bus. of mchts., brokers, and agents for merchandise, cereals, general produce, etc. Nom. Cap.: £1,000. Dirs.: H. Hodson, 26, Muswell Avenue, Muswell Hill, N. 10; M. G. J. Sohet, 14, Rue du 11 Novembre, Wygmael, Belgium; H. C. C. M. du Jardin, 5, Chemin Prive, Wygmael, Belgium.

Stitt and Sons, Limited. (323,734.) Registered January 30, 1937. To take over the bus. of mnfg. confectioners cd. on at 52, Jacktrees Road, Cleator Moor, Cumberland, as "Stitt and Sons". Nom. Cap.: £3,500. Dirs.: J. Stitt, 52, Jacktrees Road, Cleator Moor, Cumberland; R. W. Stitt, 52, Jacktrees Road, Cleator Moor, Cumberland; C. R. Stitt, 52, Jacktrees Road, Cleator Moor, Cumberland.

United Confectioners, Limited. (323,853.) Registered February 3, 1937. To carry on the bus. of mnfrs. of and dlrs. in chocolate, sweets, etc. Nom. Cap.: £1,000. Dirs.: J. A. Farmer, 624, Seven Sisters Road, Tottenham, N. 15; J. A. C. MacColl, Flat 12, Wilton Parade, Feltham, Middlesex.

A. W. Whiteley and Sons, Limited. (323,638.) Registered January 29, 1937. 38-42, Westgate, Huddersfield. To carry on the bus. of bakers, confectioners, etc., and to take over the bus. cd. on at Huddersfield as A. W. Whiteley and Sons and J. H. Whiteley. Nom. Cap.: £5,000. Dirs.: A. Milner Whiteley, 89, New North Road, Huddersfield (permt.); F. Whiteley, Bryan Lodge, Edgerton, Huddersfield (permt.); G. W. Whiteley, Bryan Lodge, Edgerton, Huddersfield.

The above-mentioned particulars of new companies recently registered have been extracted from the daily register of Messrs. Jordan and Sons, Ltd., company registration agents, Chancery Lane, W.C. 2.